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Engine Electronics IPO's

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Engine Electronics IPO's

Model: All

Production: All

OBJECTIVES

After completion of this module you will be able to:

- Understand the concept of IPO.
- Name the main IPO's for Engine Electronics
- Describe the main components of the DME Interface

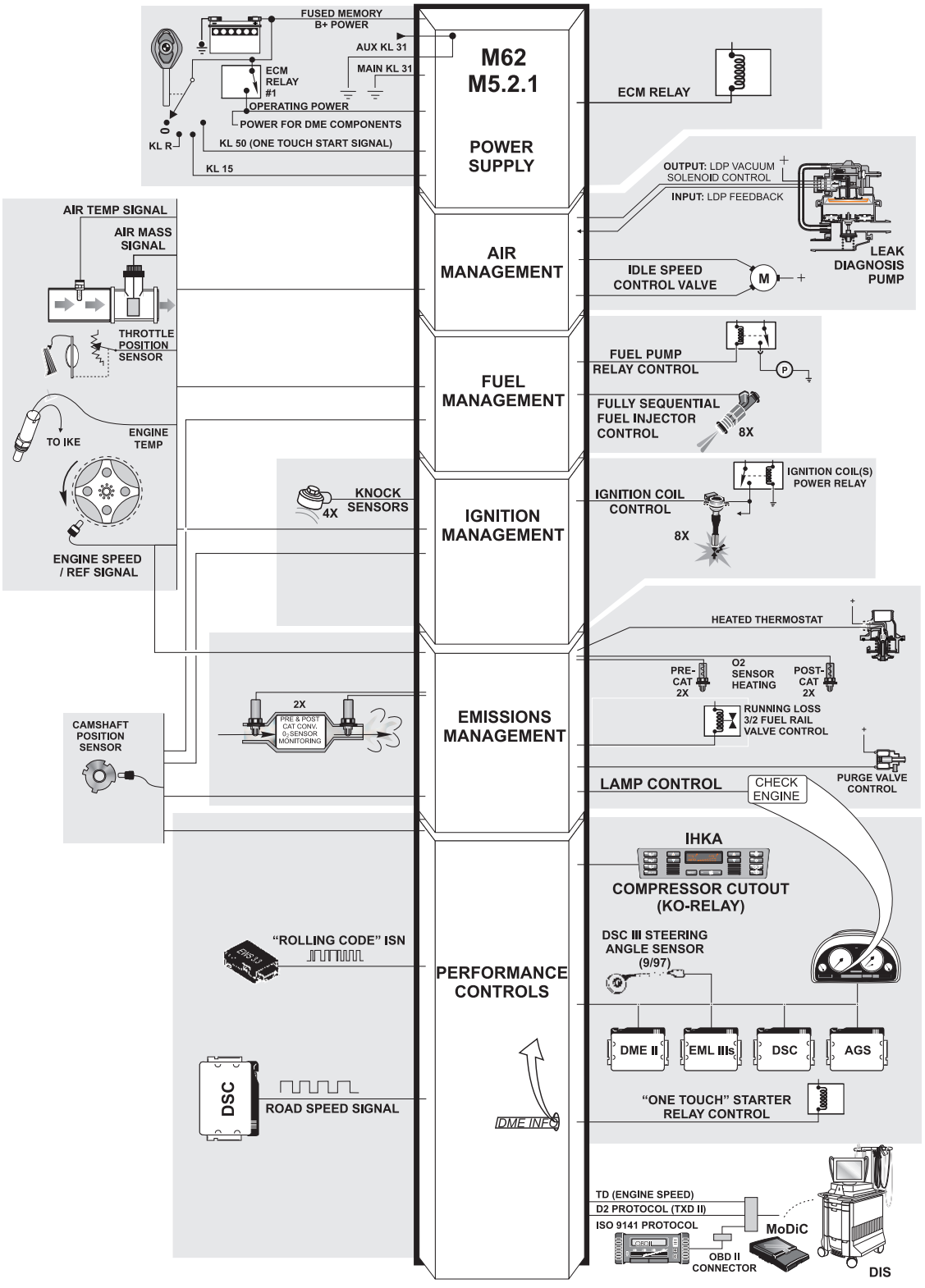
IPO's

The cart shown below is a quick reference of BMW Engine Management Systems by application to BMW models, engines and model years. This will help you get familiar with the systems by identifying the correct version that you are diagnosing.

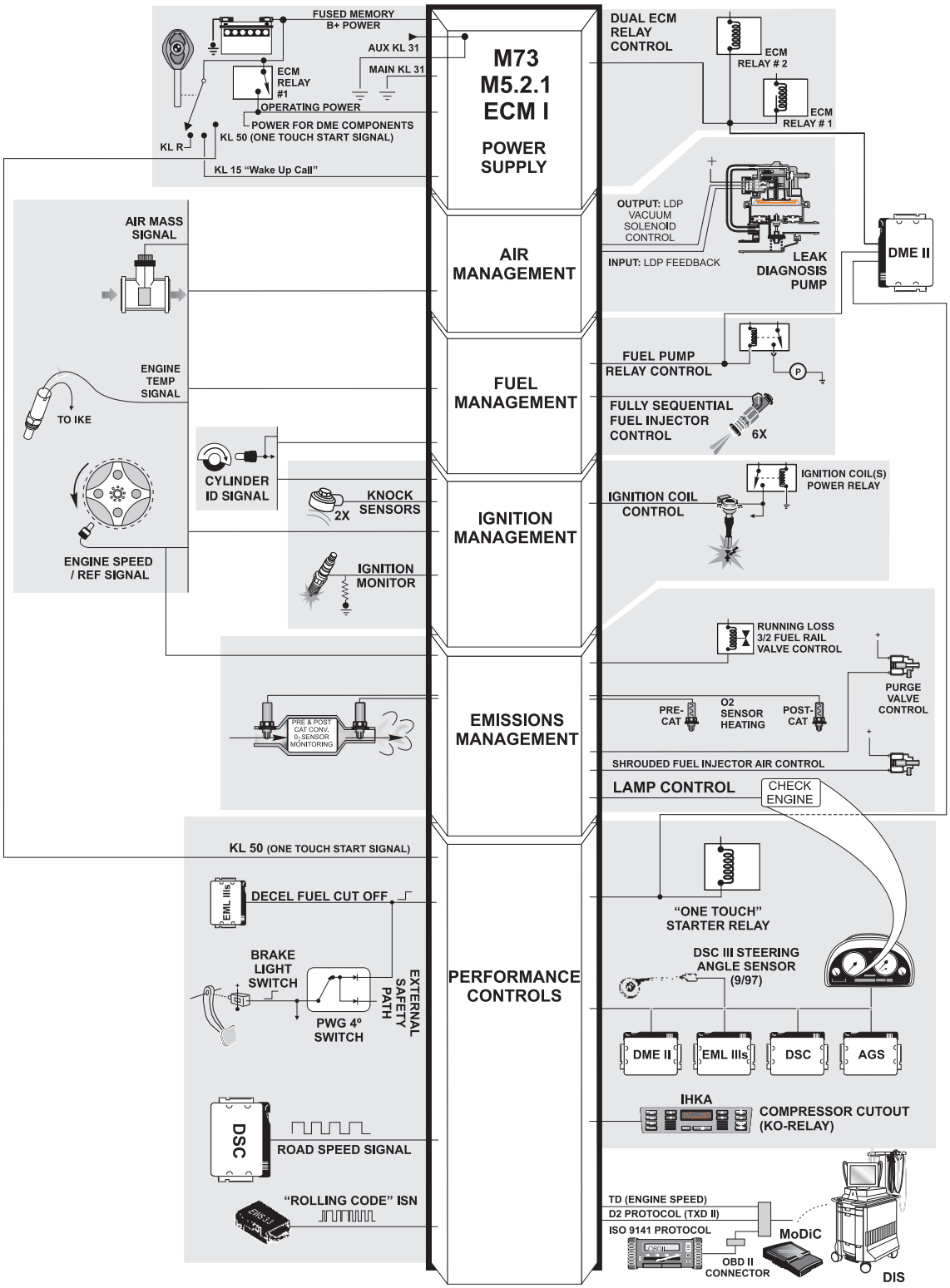
ENGINE MANAGEMENT CONTROL VERSIONS			
VERSION	**VEHICLE MODEL**	**ENGINE**	**MODEL YEAR**
M1.2	E32 / M5	M70 / S38	M70 = 1988 - 1999 S38 = 1991 - 1993
M1.7	E31 / E32	M70	1991 - 1994
M1.7	E30	M42	1990 - 1993
M1.7	E36	M42	1992 - 1995
M1.7	E36	M42 / DISA	1995
M1.7.1	E31	S70	1991 - 1992
M1.7.2	E36	M42 /DISA	1992
M3.1	E34	M50	1991 - 1992
M3.1	E36	M50	1992
M3.3	E32	M60	1993 - 1994
M3.3	E31 / E34	M60	1994 - 1995
M3.3.1	E34 / E36	M50TU	1993 - 1995
M5.2	E36 / Z3	M44	1996 - 1998
M5.2	E31 / E38 / E39	M62 / M73	1995 - 1997
MS41.1	E36 / E39 /Z3	M52	1996 - 1998
MS41.2	E36 M3	S52	1996 - 1998
M5.2.1	E38 / E39	M62 / M73	1998 - 1999
MS42	E46 / E39 /Z3	M52TU	1998 - 2000
MS43	E46 / E39 / E53 / Z3	M54	E46 2001 - 2002 Z3 2001 - 2002 E39 2001 - 2003 E53 2001 - 2006
ME7.2	E39 / E38 / E53	M62TU	1999 - 2001
MS S52	E39 M5 / E52 Z8	S62	M5 1999 - 2003 Z8 2000 - 2003
MS S54	E46 M3	S54	2001 -2007
			BOSH = M; SIEMENS = MS

ENGINE MANAGEMENT CONTROL VERSIONS			
VERSION	**VEHICLE MODEL**	**ENGINE**	**MODEL YEAR**
MS45	E85	M54	2003 - 2006
MS45	E83 all except M54B30 AUTO	M54	2003 - 2006
MS54.1	E83 with M54B30 auto	M54	2003 - 2006
MS45.1	E46	M54	2003 - 2006
MS45.1	E46	M56 SULEV	2003 - 2006
ME 9.2	E65/66	N62	2002 - 2003
ME9.2.1	E53 / E60 / E63 / E64 / E65 / E66	N62	2004 - 2004
ME 9.2.2	E53 / E60 / E63 / E64 / E65 / E66	N62	2005 - 2007
MED 9.2.1	E66	N73	2003 - 2006
ME 9.2.3	E70	N62	2006 - 2010
MSS65	M5, M6 (E6x)	S85	2006 - 2009
MSV70	E90, E91, E92, E93, E60, E70.	N52	2004 - 2006
MSV80	E82, E88, E90, E91, E92, E93, E60, E70.	N52KP	2006 -
MSD80	E82, E90, E92, E93, E60, E61.	N54	2006 - 2008
MSD81	E70, E71, E82, E84, E88, E89, E90, E92, E93, F07, F10	N54	2008 -
MEVD 17.2	E82, E88, E90, E91, E92, E93, E60, E70.	N55	2010 -
MSD85	E70, E71, E72, F01, F02, F04, F07, F10	N63	2009 -
MSD85.1	E70 M / E71 M	S63	2009 -
MSD87-12	F01, F02	N74	2009 -
			BOSH = M; SIEMENS = MS

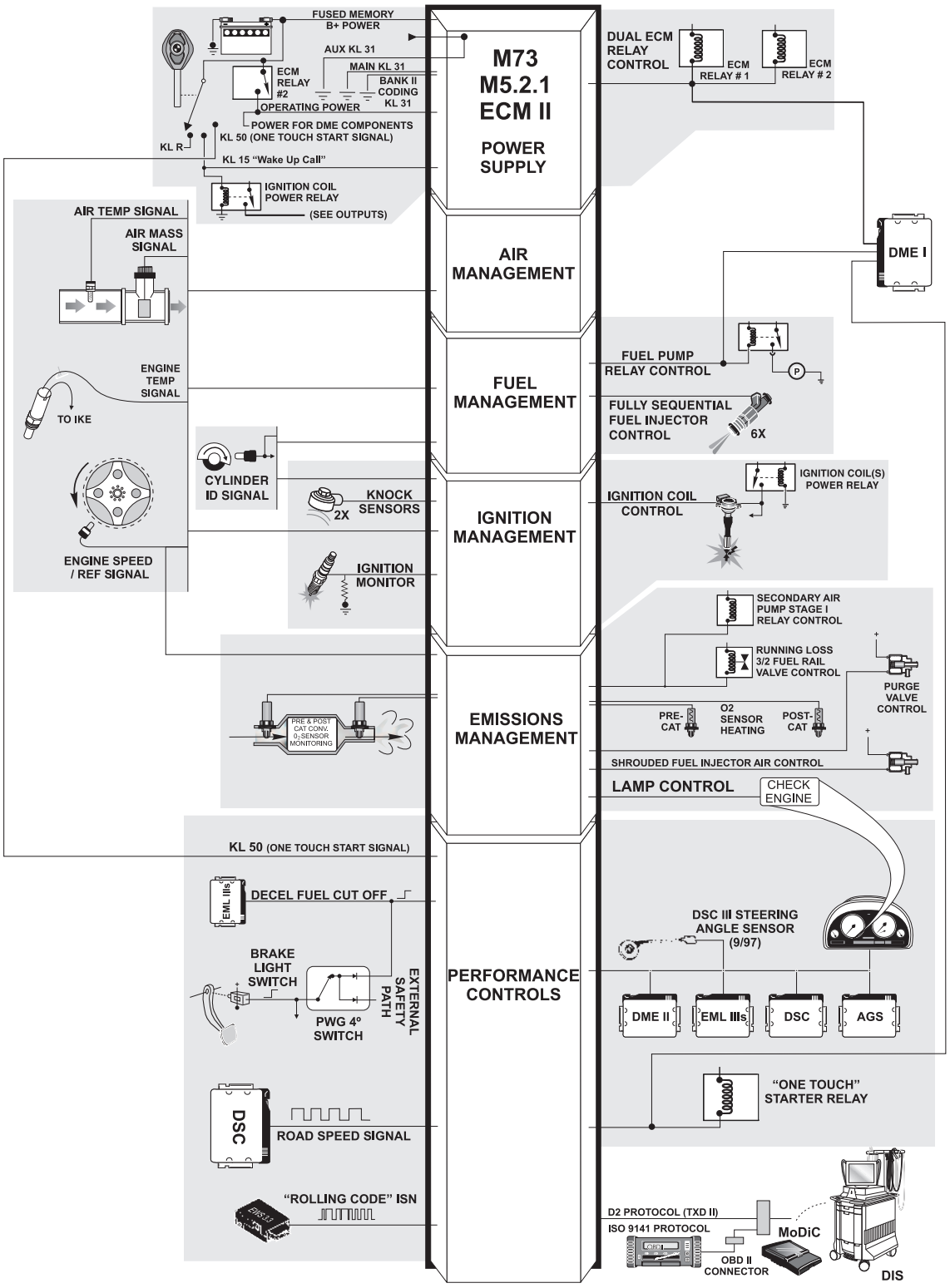
M5.2.1: Inputs - Processing - Outputs



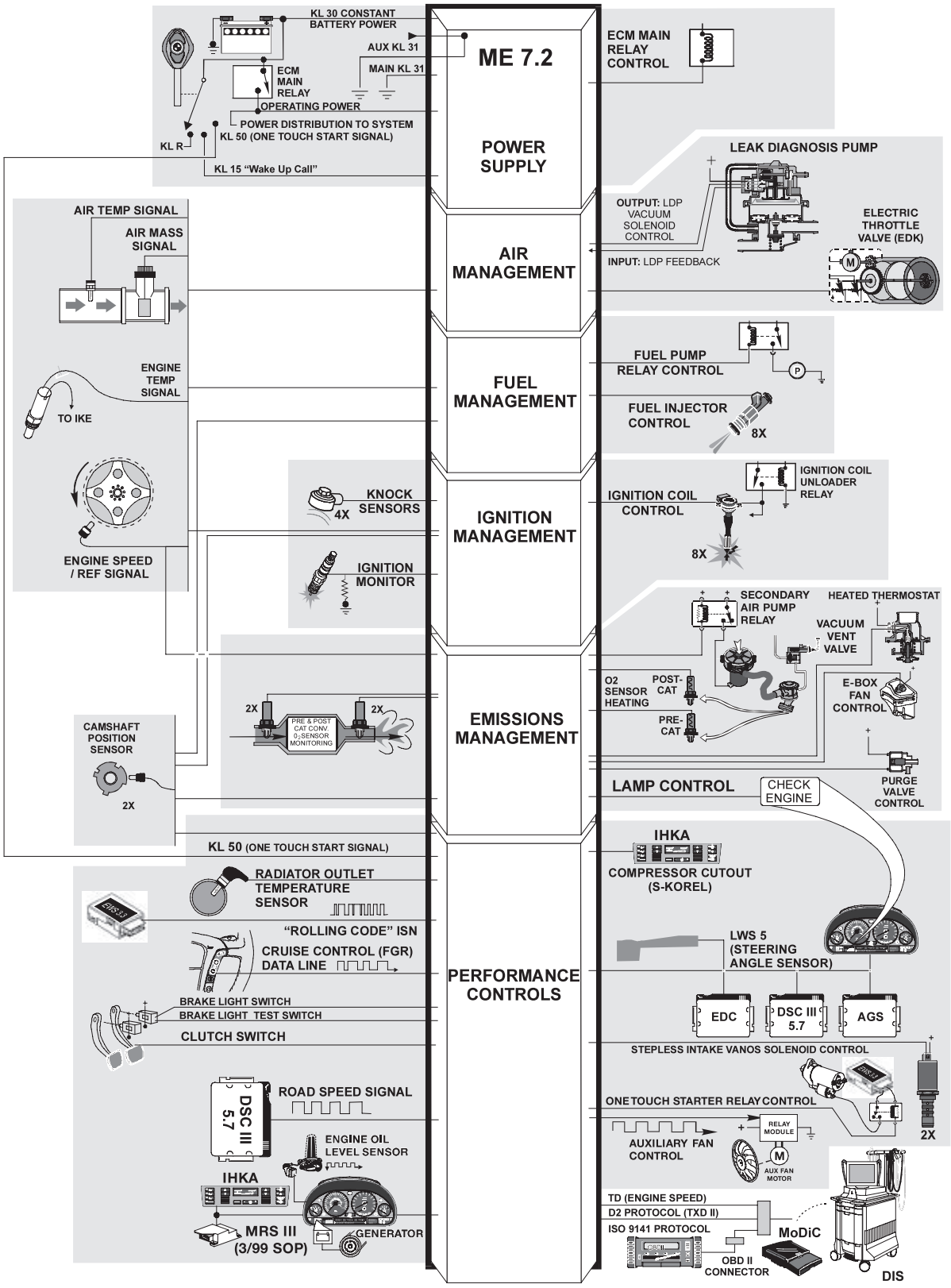
M5.2.1 ECM I: Inputs - Processing - Outputs



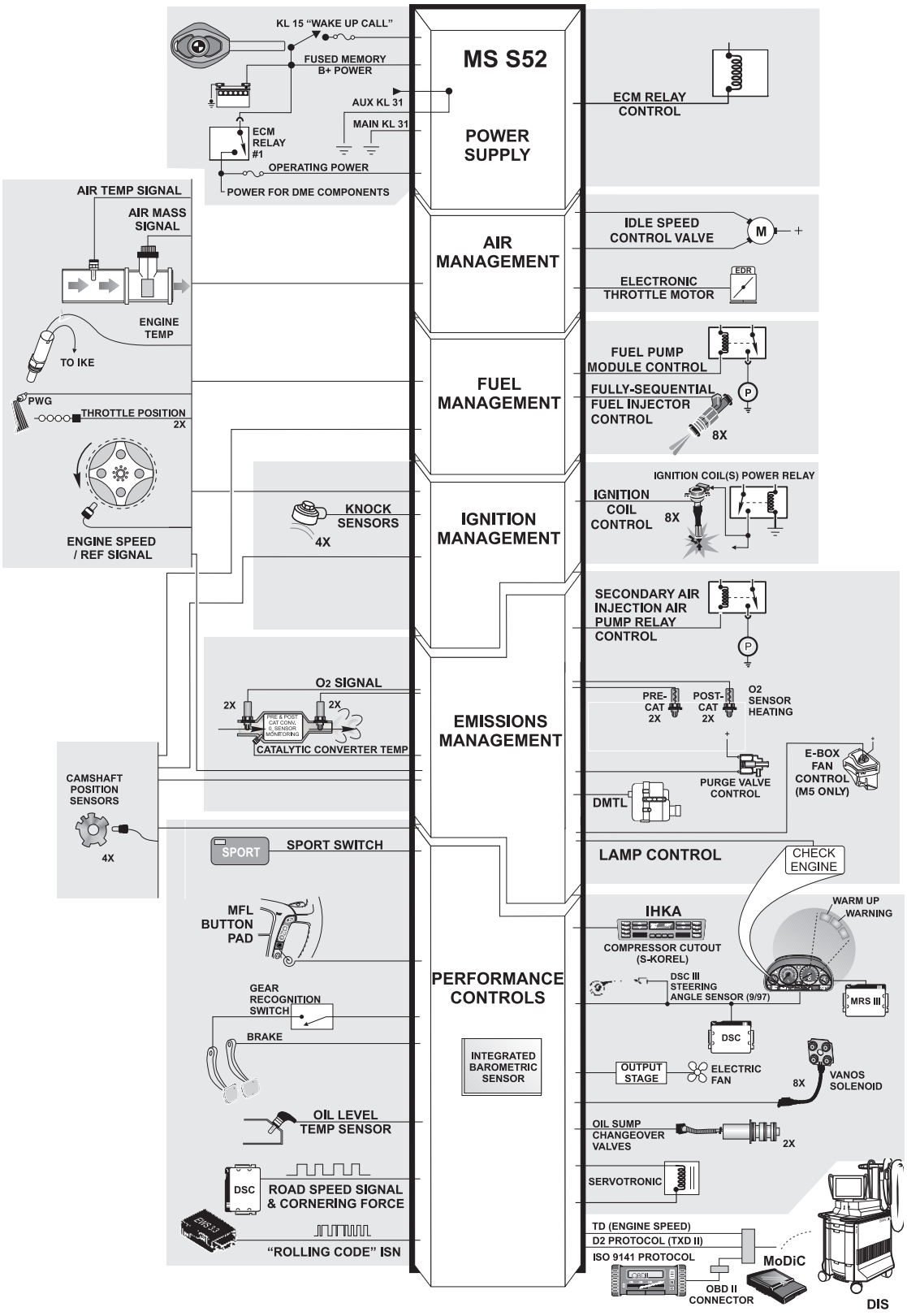
M5.2.1 ECM II: Inputs - Processing - Outputs



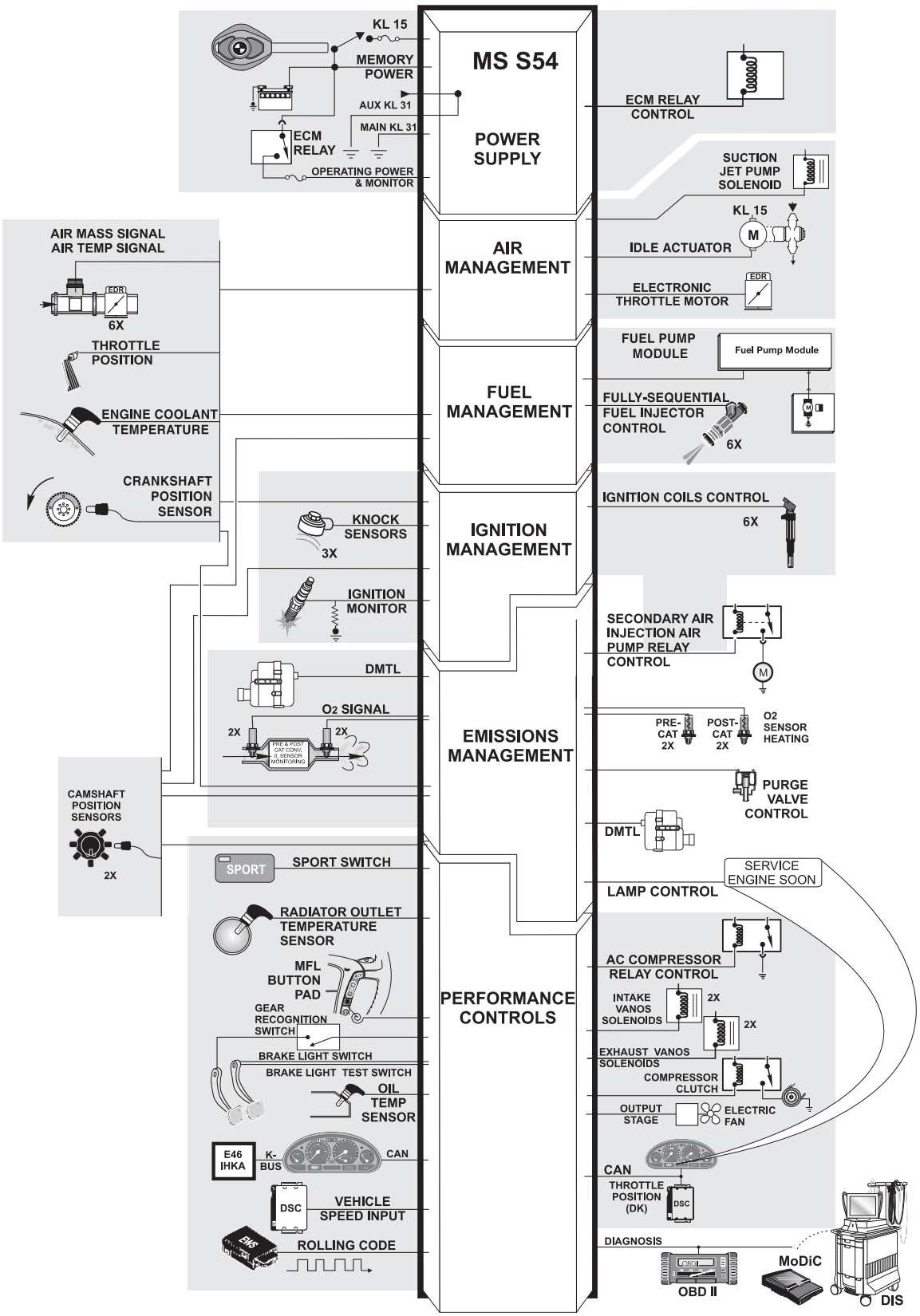
ME7.2: Inputs - Processing - Outputs



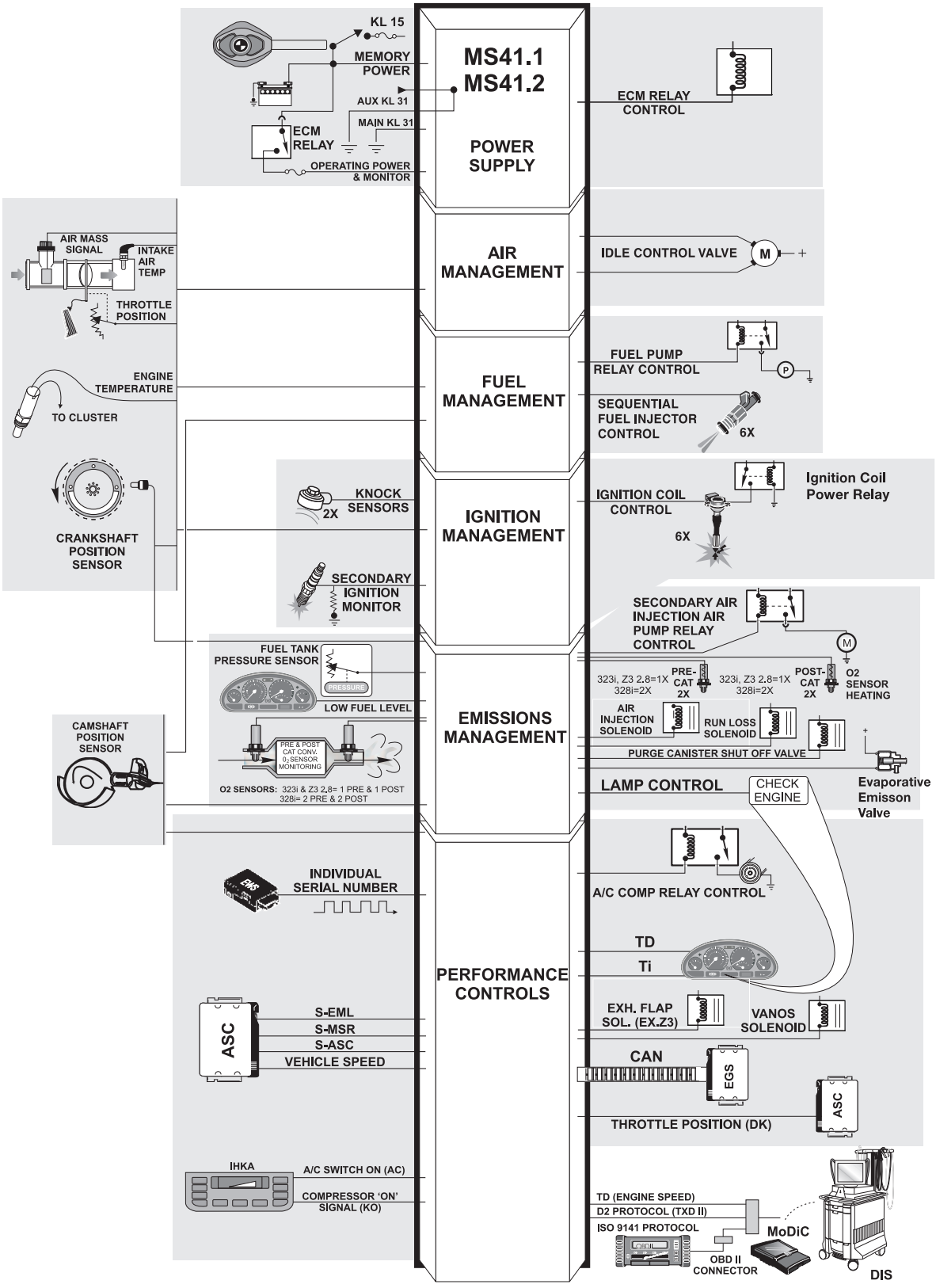
MS S52: Inputs - Processing - Outputs



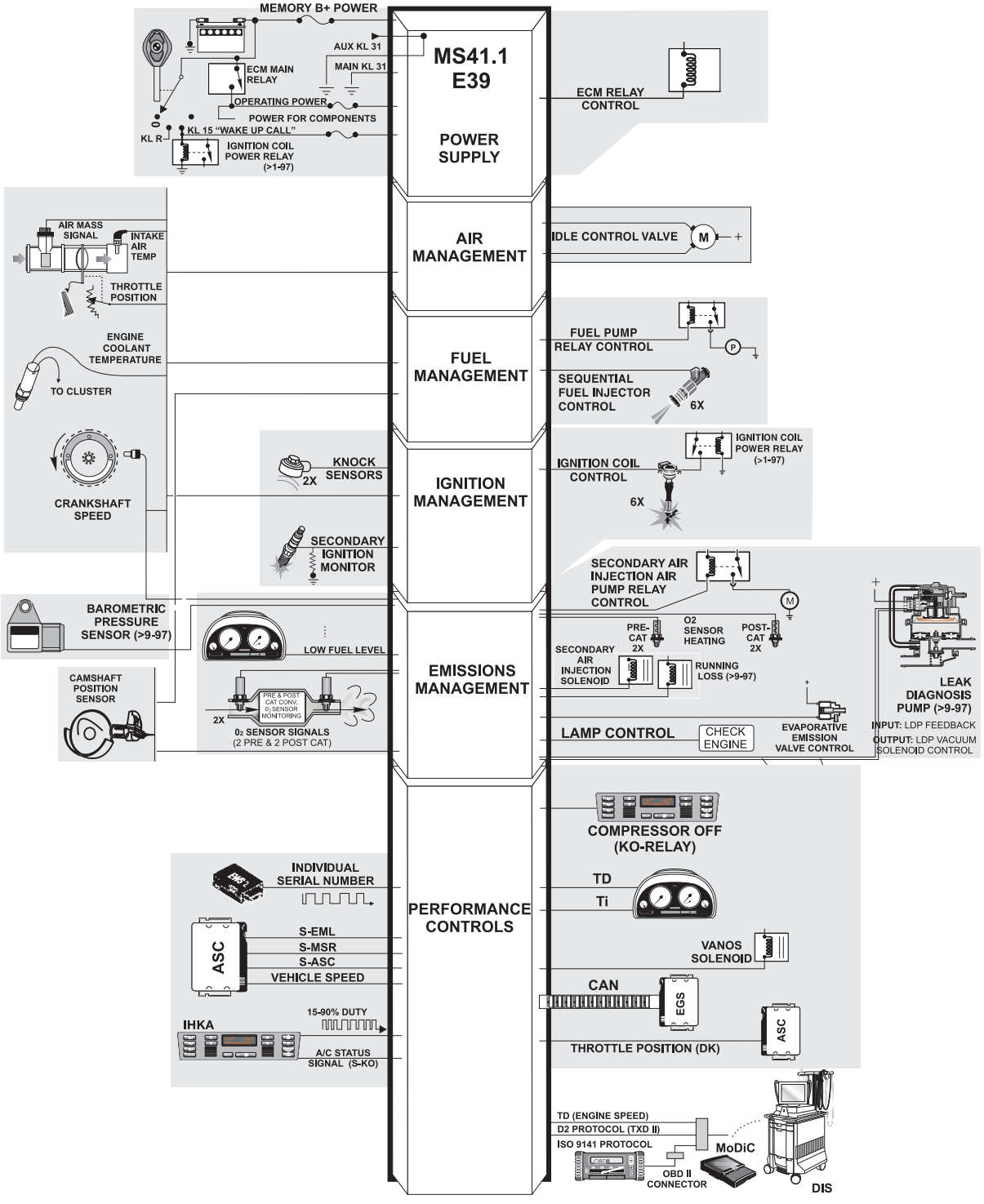
MS S54: Inputs - Processing - Outputs



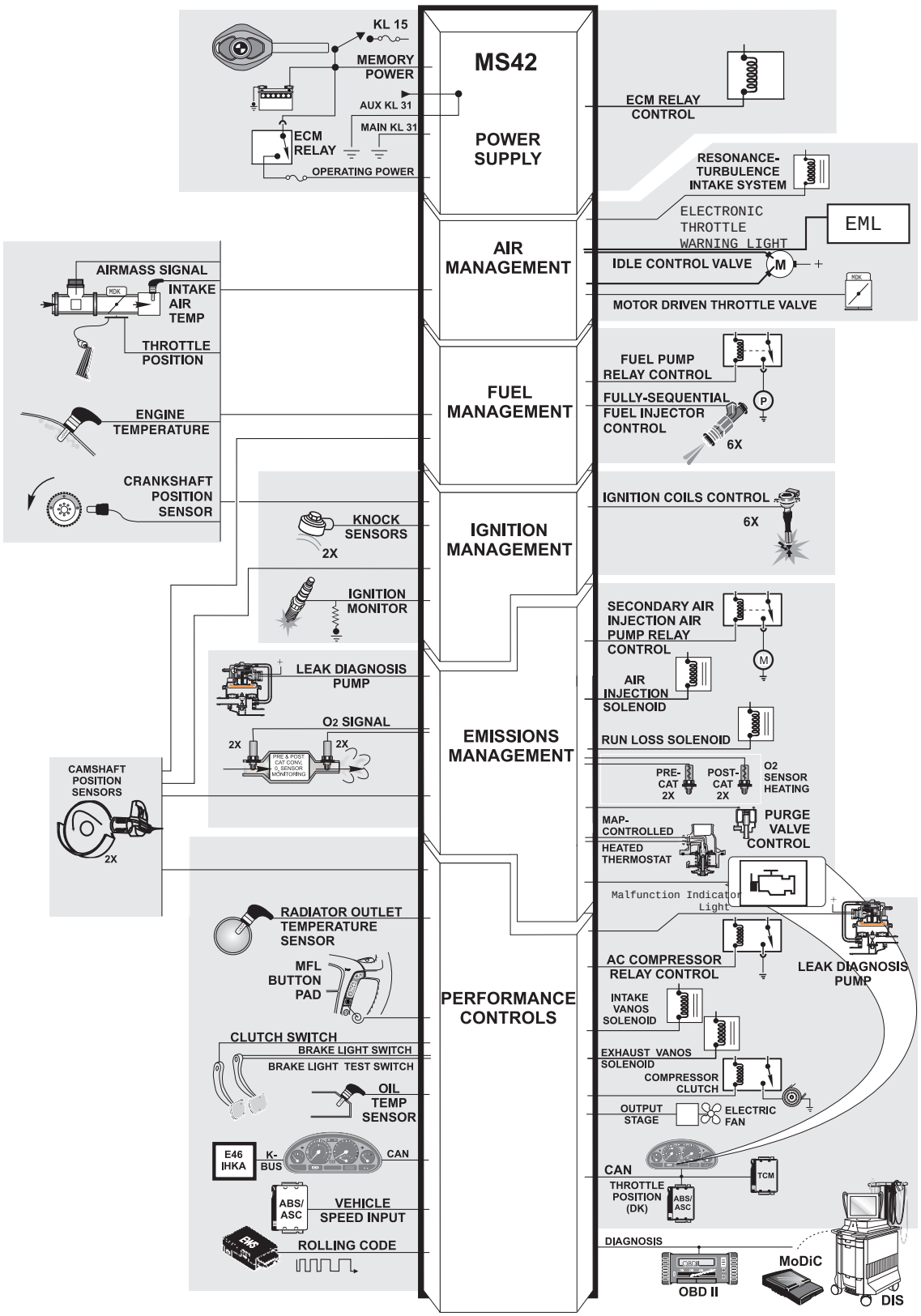
MS41.1 & MS41.2: Inputs - Processing - Outputs



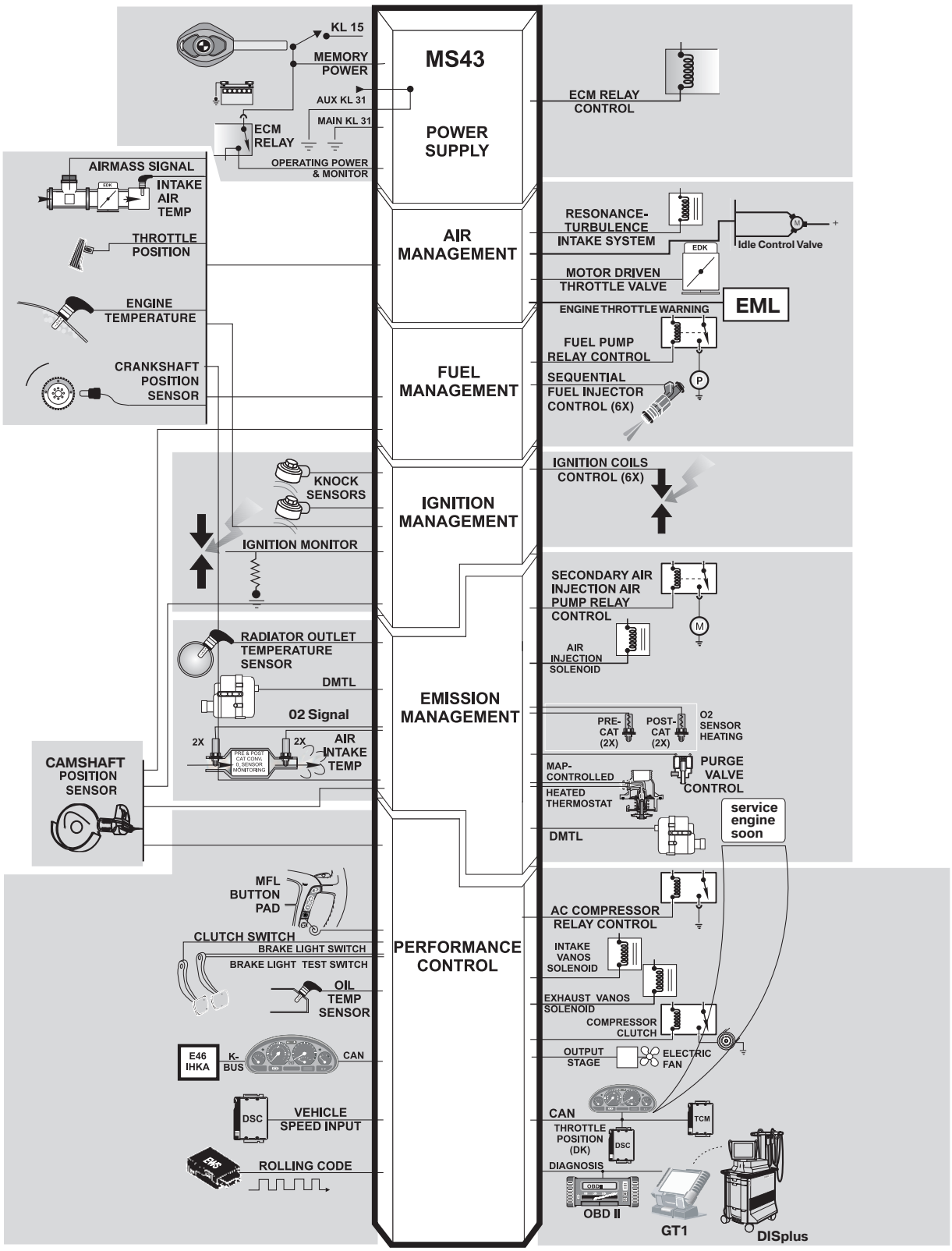
MS41.1: Inputs - Processing - Outputs



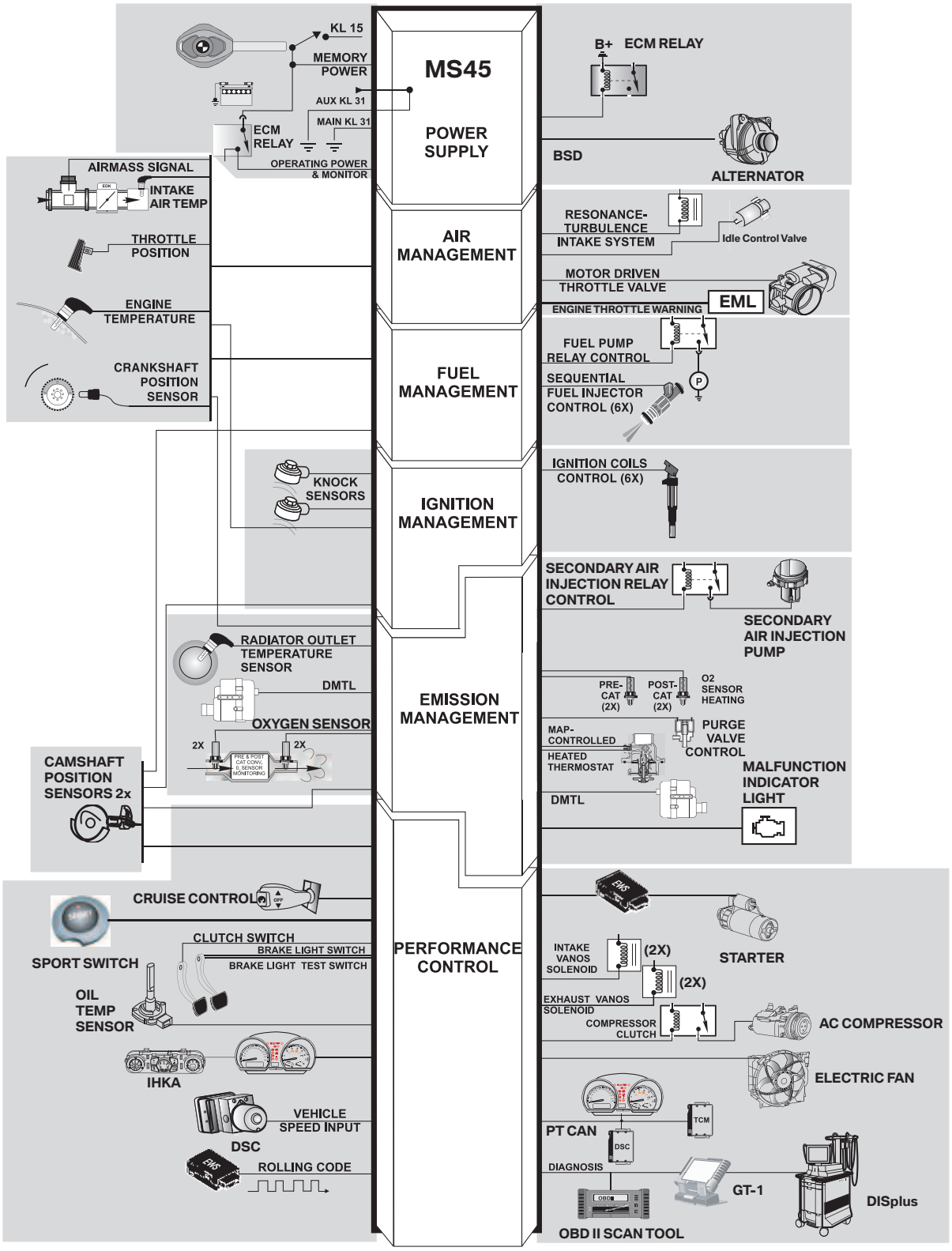
MS42: Inputs - Processing - Outputs



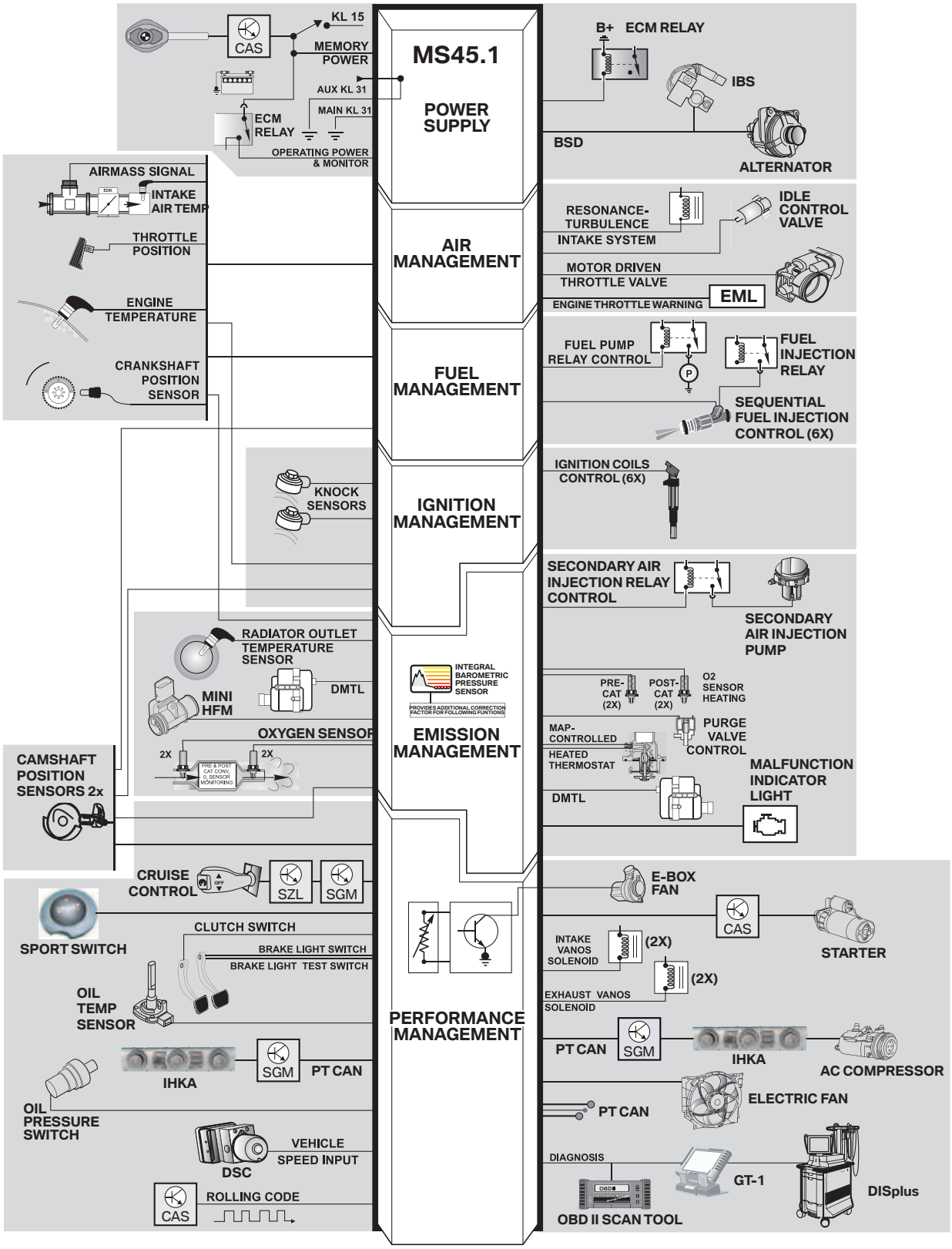
MS43: Inputs - Processing - Outputs



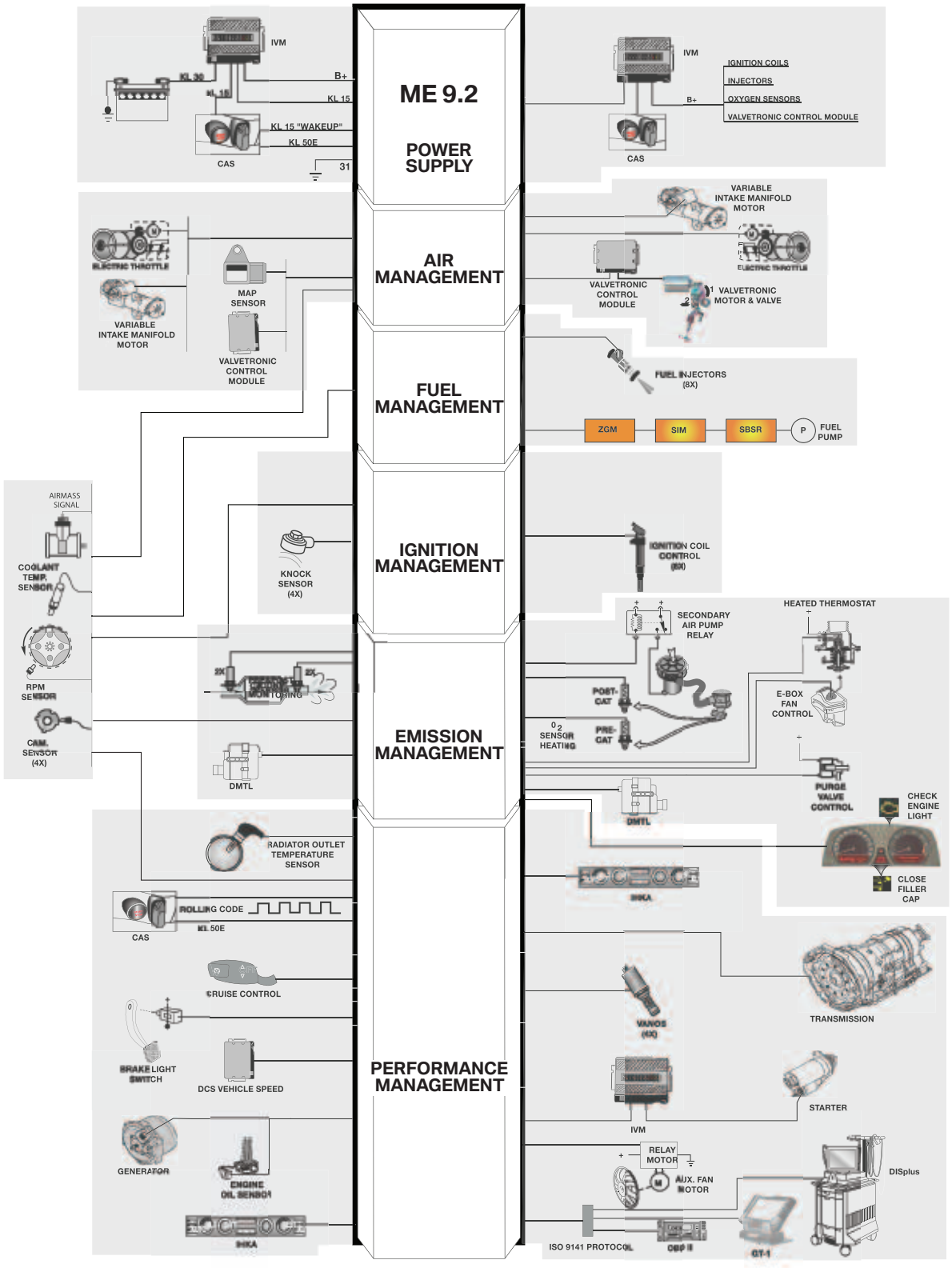
MS45: Inputs - Processing - Outputs



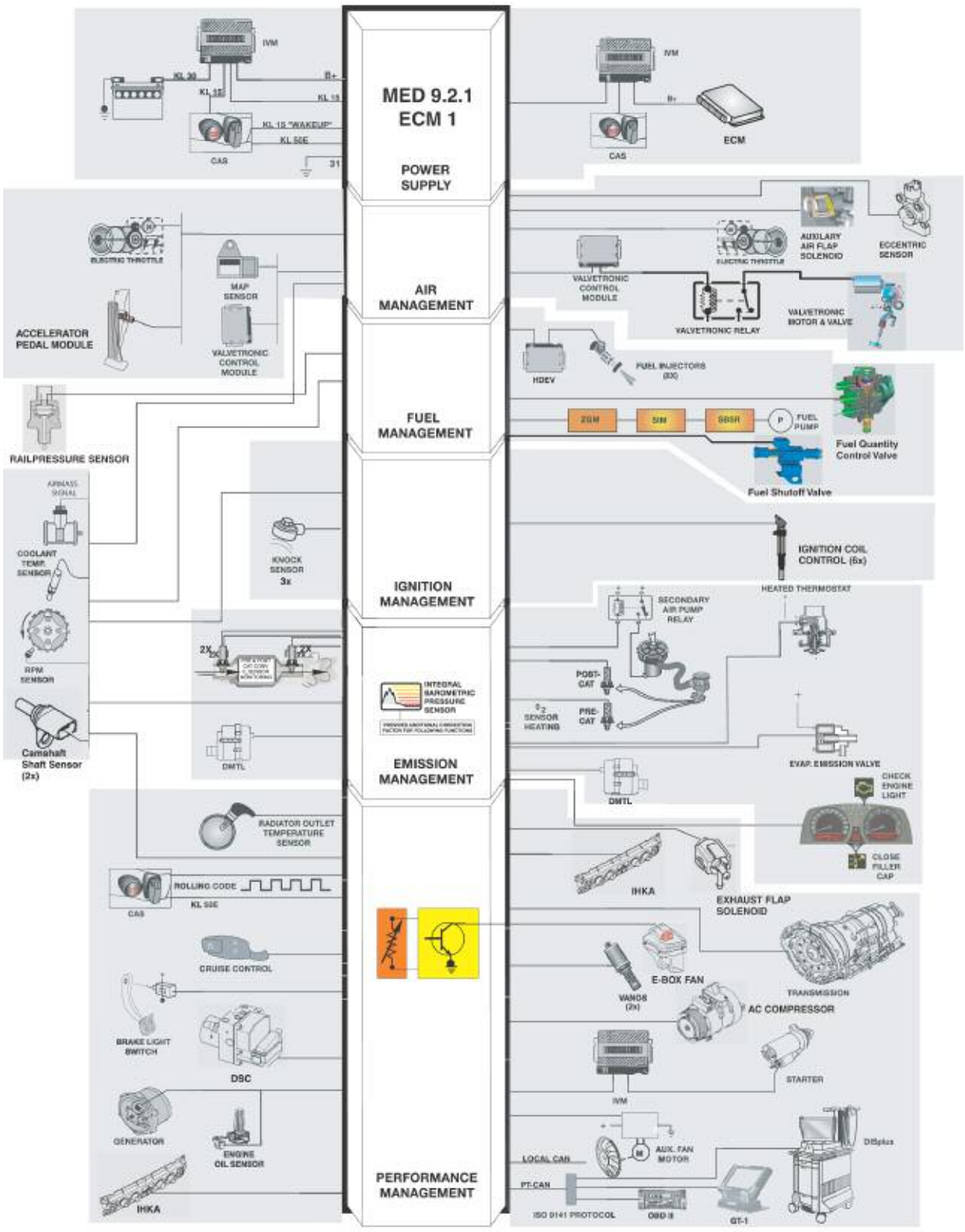
MS45.1: Inputs - Processing - Outputs



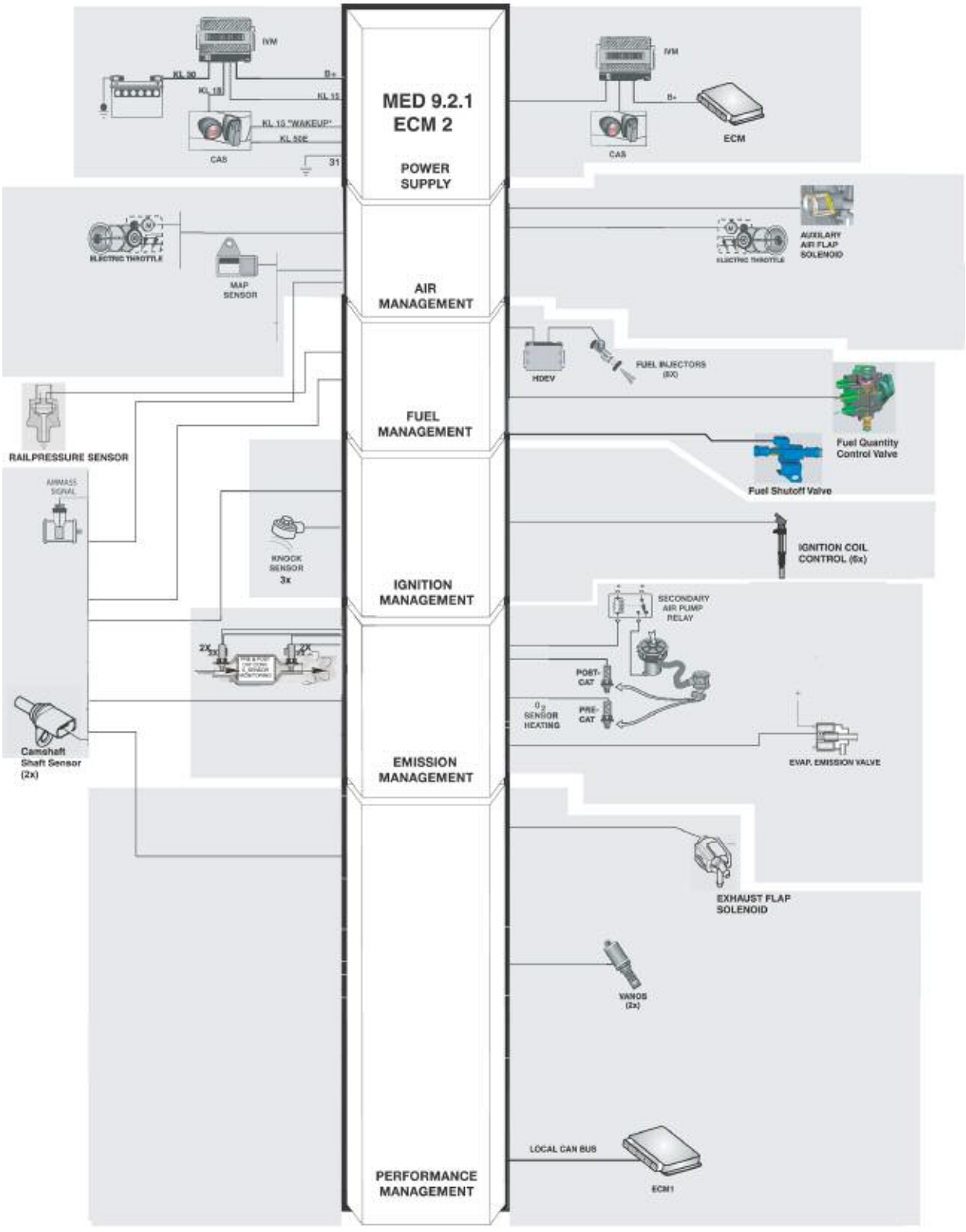
ME 9.2: Inputs - Processing - Outputs



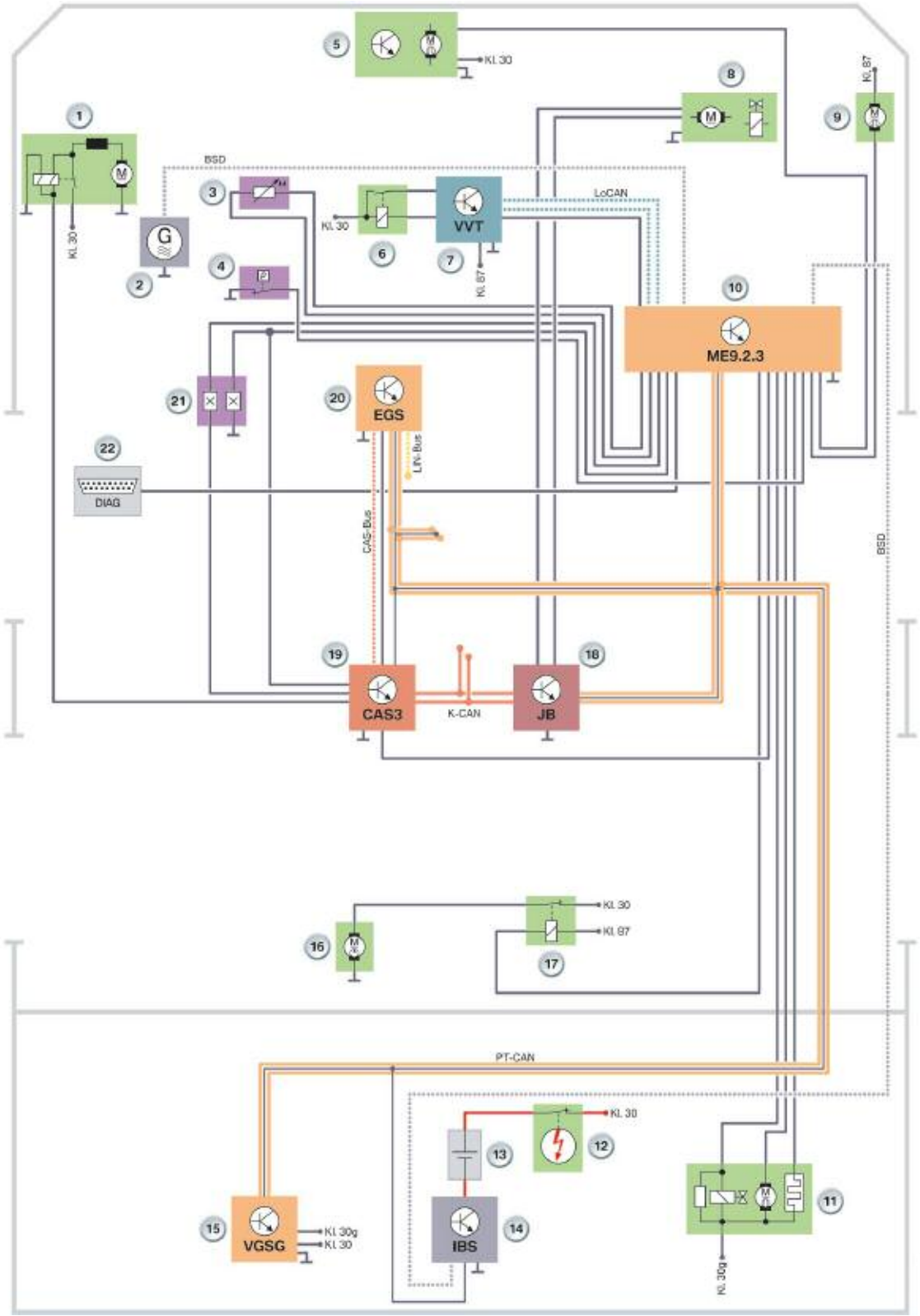
MED 9.2.1: Inputs - Processing - Outputs



MED 9.2.1: Inputs - Processing - Outputs

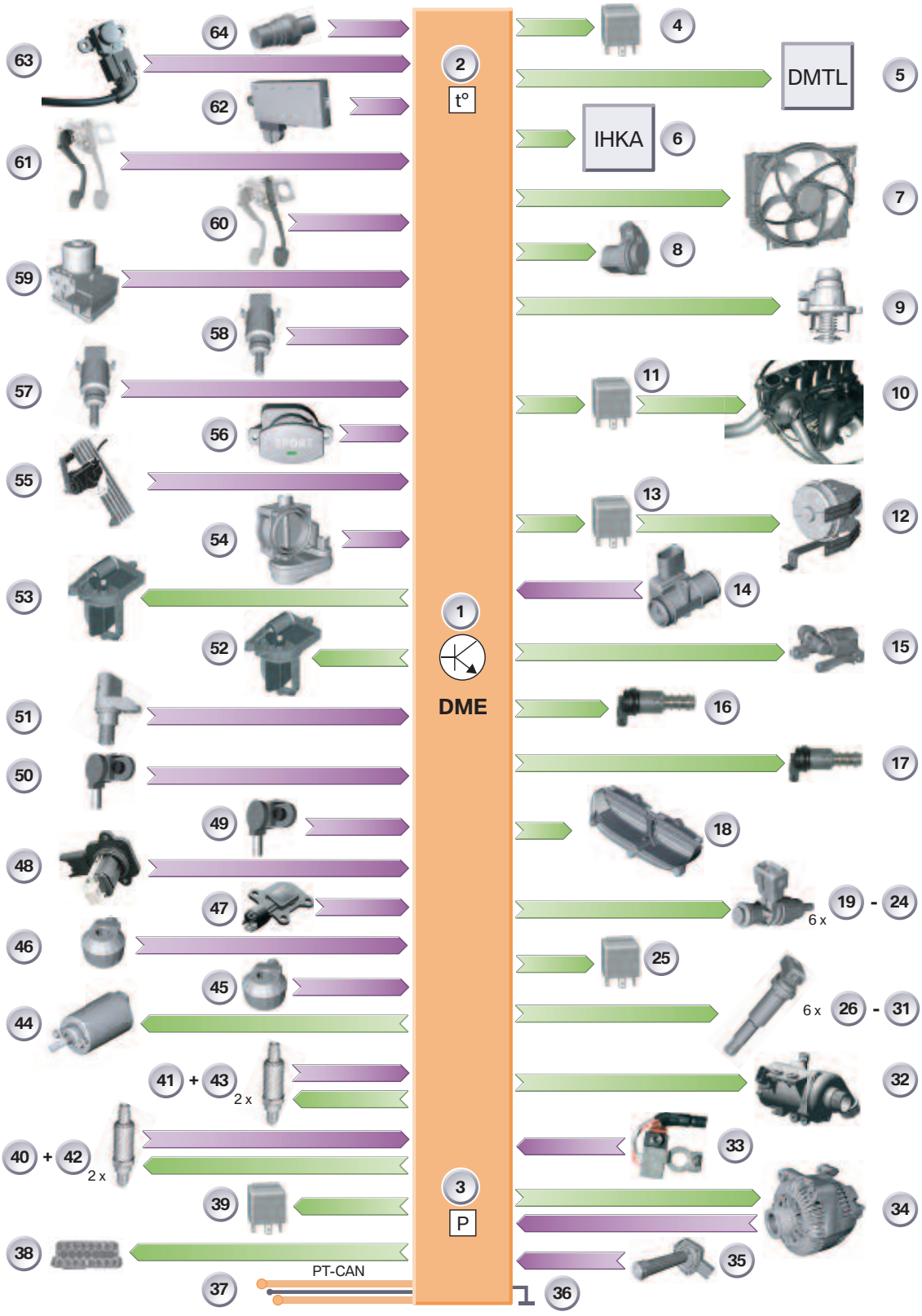


MED 9.2.3: DME Interface (N62)



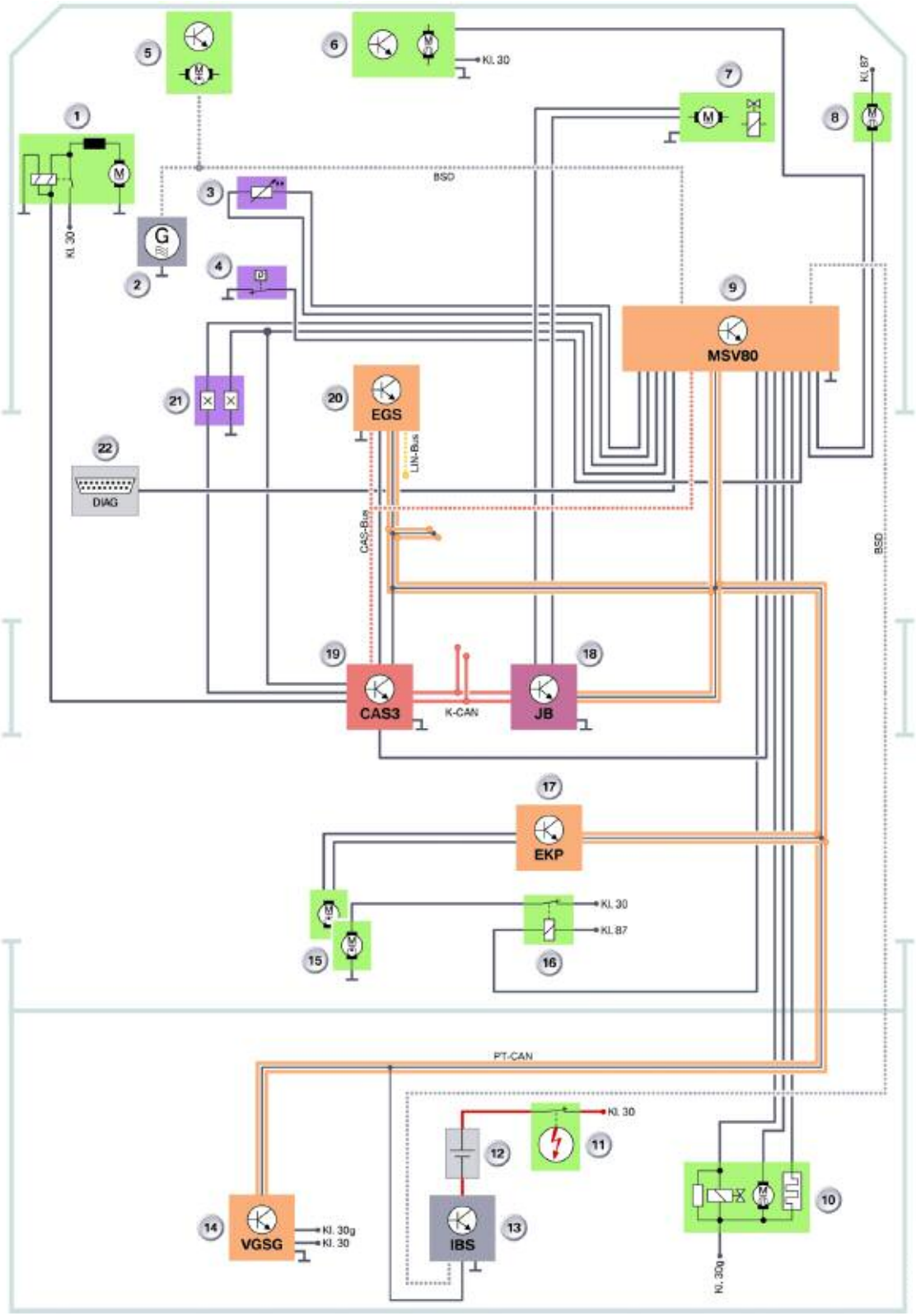
Index	Explanation
1	Starter
2	Alternator
3	Coolant temperature sensor at radiator outlet
4	Oil pressure switch
5	Electric fan (engine cooling)
6	VALVETRONIC relay
7	VALVETRONIC control unit
8	Magnetic clutch, A/C compressor
9	E-box fan
10	DME control unit (Digital Motor Electronics)
11	Diagnosis module for fuel tank leakage (DMTL)
12	Safety battery terminal
13	Battery
14	Intelligent battery sensor
15	Transfer box control unit
16	Electric fuel pump (EKP)
17	EKP relay
18	Junction box control unit
19	CAS control unit (Car Access System)
20	EGS control unit (Electronic Transmission Control)
21	Brake light switch
22	Diagnosis connection

MSV70: Inputs - Processing - Outputs



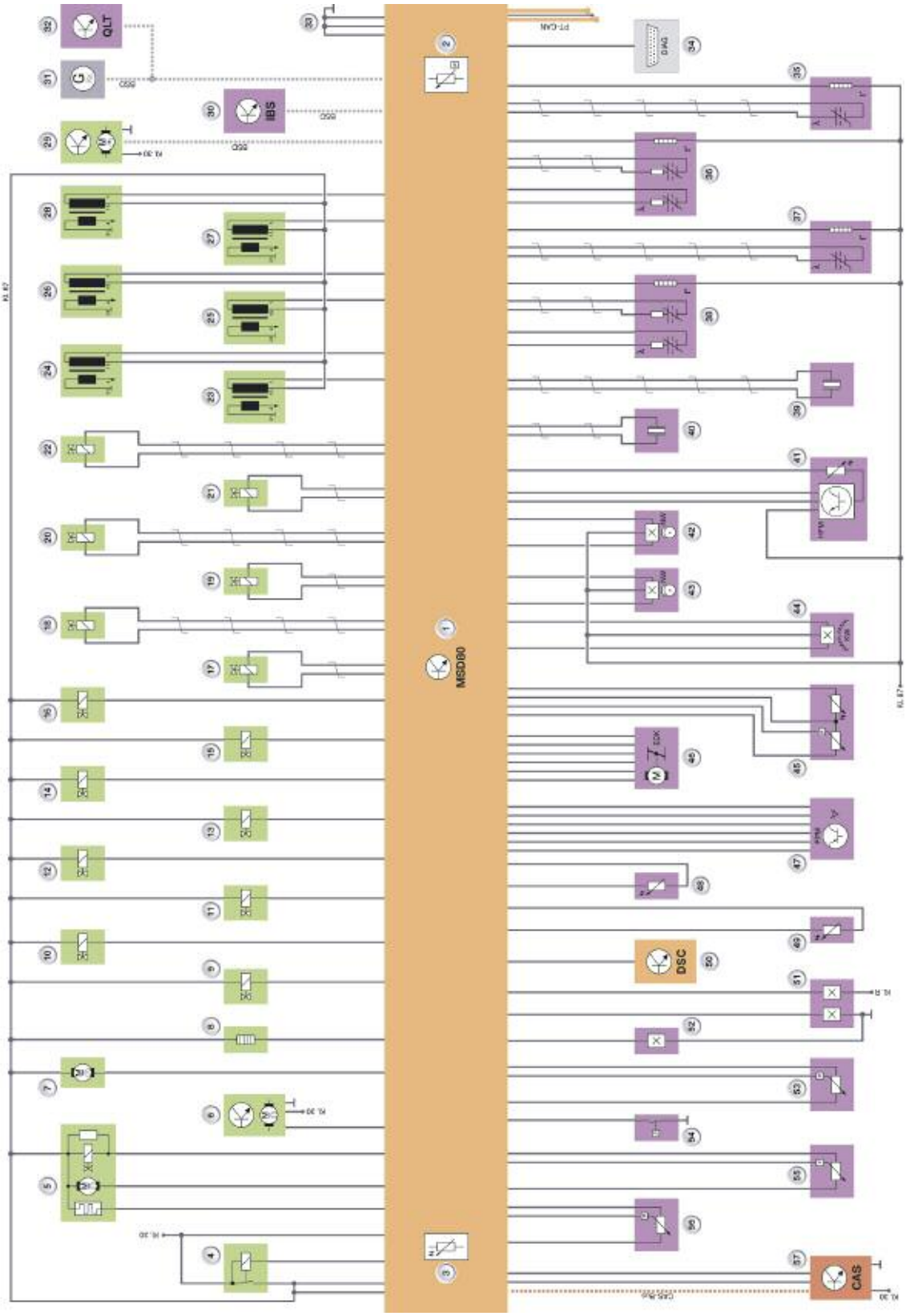
Index	Explanation	Index	Explanation
1	DME (ECM)	38	Diagnosis connection
2	Integral ambient temperature sensor	39	Valvetronic relay
3	Integral ambient pressure sensor	40	Oxygen Sensor
4	DME (ECM) main relay	41	Oxygen Sensor
5	DM-TL	42	Oxygen Sensor
6	IHKA	43	Oxygen Sensor
7	Electric engine cooling fan	44	Valvetronic motor
8	E-Box fan	45	Knock sensor (cyl 1-3)
9	Characteristic map thermostat	46	Knock sensor (cyl 4-6)
10	Crankcase ventilation heater	47	Eccentric shaft sensor
11	Crankcase ventilation heater relay	48	Hot-film air mass meter (HFM)
12	Secondary air pump	49	Exhaust camshaft sensor
13	Secondary air pump relay	50	Intake camshaft sensor
14	HFM for Secondary air	51	Crankshaft sensor
15	Fuel tank vent valve (TEV)	52	DISA actuator
16	VANOS solenoid valve (Intake cam)	53	DISA Actuator
17	VANOS solenoid valve (Exhaust cam)	54	Electric Throttle Valve (EDK)
18	Electro-magnet for airflap control (not for US)	55	Accelerator Pedal Module (FPM)
19-24	Fuel injectors	56	SPORT button
25	Fuel injector relay	57	Coolant temperature sensor (engine temp)
26-31	Ignition coils	58	Coolant temperature sensor (radiator outlet)
32	Electric coolant pump	59	DSC module
33	Intelligent Battery Sensor (IBS)	60	Brake Light Switch (BLS)
34	Alternator	61	Clutch switch
35	Oil Condition Sensor (OZS)	62	Car Access System (CAS)
36	Ground connection	63	Differential pressure sensor
37	PT-CAN	64	Oil pressure switch

MSV80 (N52KP): DME Interface



Index	Explanation
1	Starter
2	Alternator
3	Coolant temperature sensor at radiator outlet
4	Oil pressure switch
5	Electric coolant pump (EWP)
6	Electric fan (engine cooling)
7	Magnetic clutch, A/C compressor
8	E-box fan
9	DME control unit (Digital Motor Electronics)
10	Diagnosis module for fuel tank leakage (DMTL)
11	Safety battery terminal
12	Battery
13	Intelligent battery sensor
14	Transfer box control unit
15	Electric fuel pump (EKP)
16	EKP relay
17	EKP module (only ECE)
18	Junction box control unit
19	CAS control unit (Car Access System)
20	EGS control unit (Electronic Transmission Control)
21	Brake light switch
22	Diagnosis connection

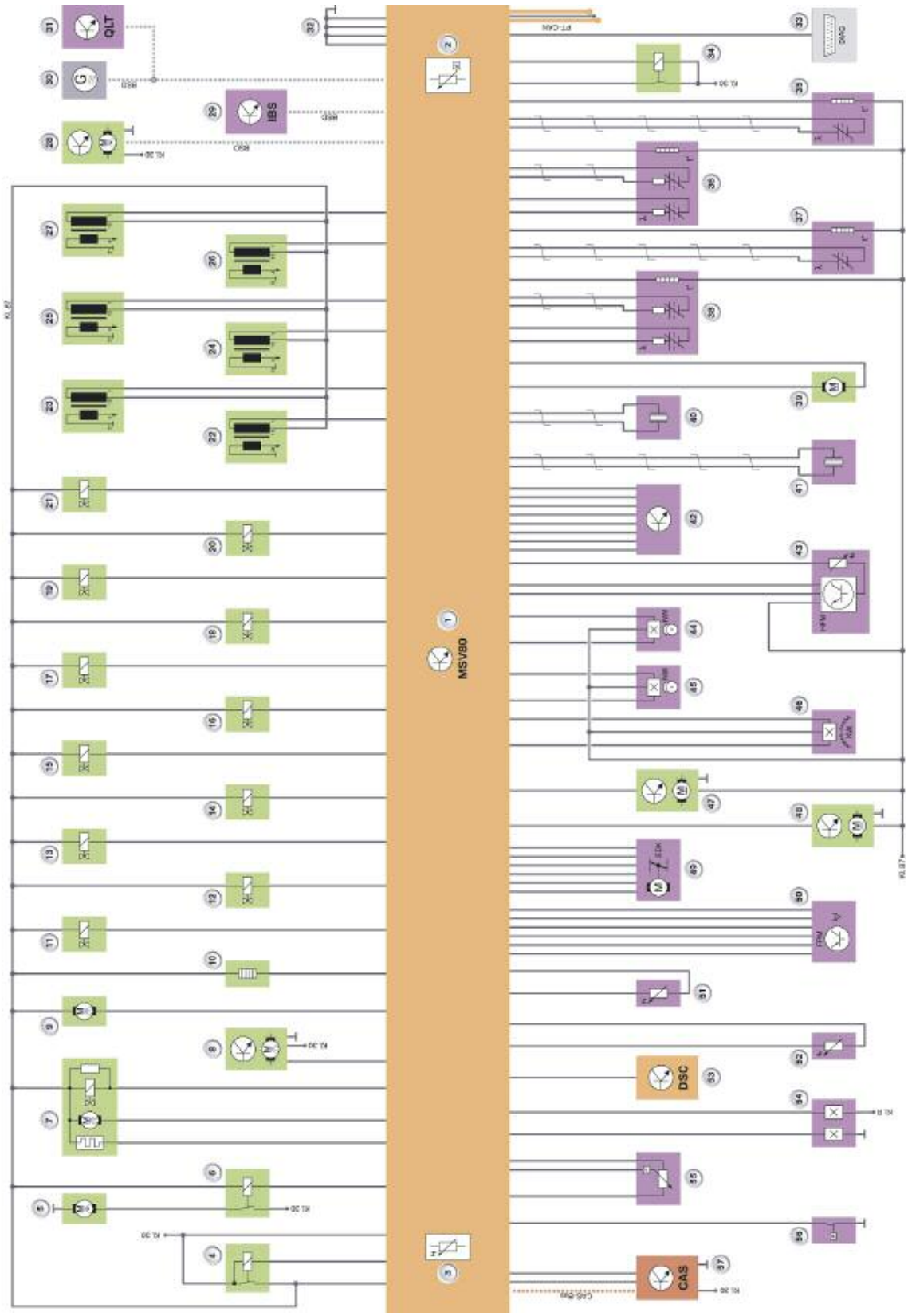
MSD80 (E9x): Inputs – Processing – Outputs



Index	Explanation
1	ECM (DME - MSD80)
2	Temperature sensor in DME control unit
3	Ambient-pressure sensor in DME control unit
4	DME main relay
5	Diagnosis module for fuel tank leakage (DMTL)
6	Electric fan (engine cooling)
7	E-box fan
8	Characteristic map thermostat
9	Fuel tank vent valve (TEV)
10	VANOS solenoid valve, inlet
11	VANOS solenoid valve, exhaust
12	Sound flap
13	Exhaust flap
14	Fuel-supply control valve
15	Wastegate valve, bank 1
16	Wastegate valve, bank 2
17-22	Piezo-injectors
23-28	Ignition coils
29	Electric coolant pump
30	Intelligent battery sensor
31	Alternator
32	Oil condition sensor
33	Ground connection

Index	Explanation
34	Diagnostics connection
35	Oxygen sensor (secondary O2 sensor with discontinuous characteristic)
36	Oxygen sensor (primary O2 sensor with continuous characteristic)
37	Oxygen sensor (secondary O2 sensor with discontinuous characteristic)
38	Oxygen sensor (primary oxygen sensor with continuous characteristic)
39-40	Knock sensors
41	Hot-film air-mass sensor (HFM)
42	Camshaft sensor, inlet
43	Camshaft sensor, exhaust
44	Crankshaft sensor
45	Pressure/temperature sensor before throttle valve (boost pressure)
46	Throttle valve
47	Accelerator pedal module
48	Coolant-temperature sensor at engine outlet
49	Coolant-temperature sensor at radiator outlet
50	DSC control unit (Dynamic Stability Control)
51	Brake-light switch
52	Clutch switch
53	Pressure sensor after throttle valve (intake-manifold pressure)
54	Oil pressure switch
55	Low-pressure fuel sensor
56	High-pressure fuel sensor (rail pressure sensor)
57	CAS control unit (Car Access System)

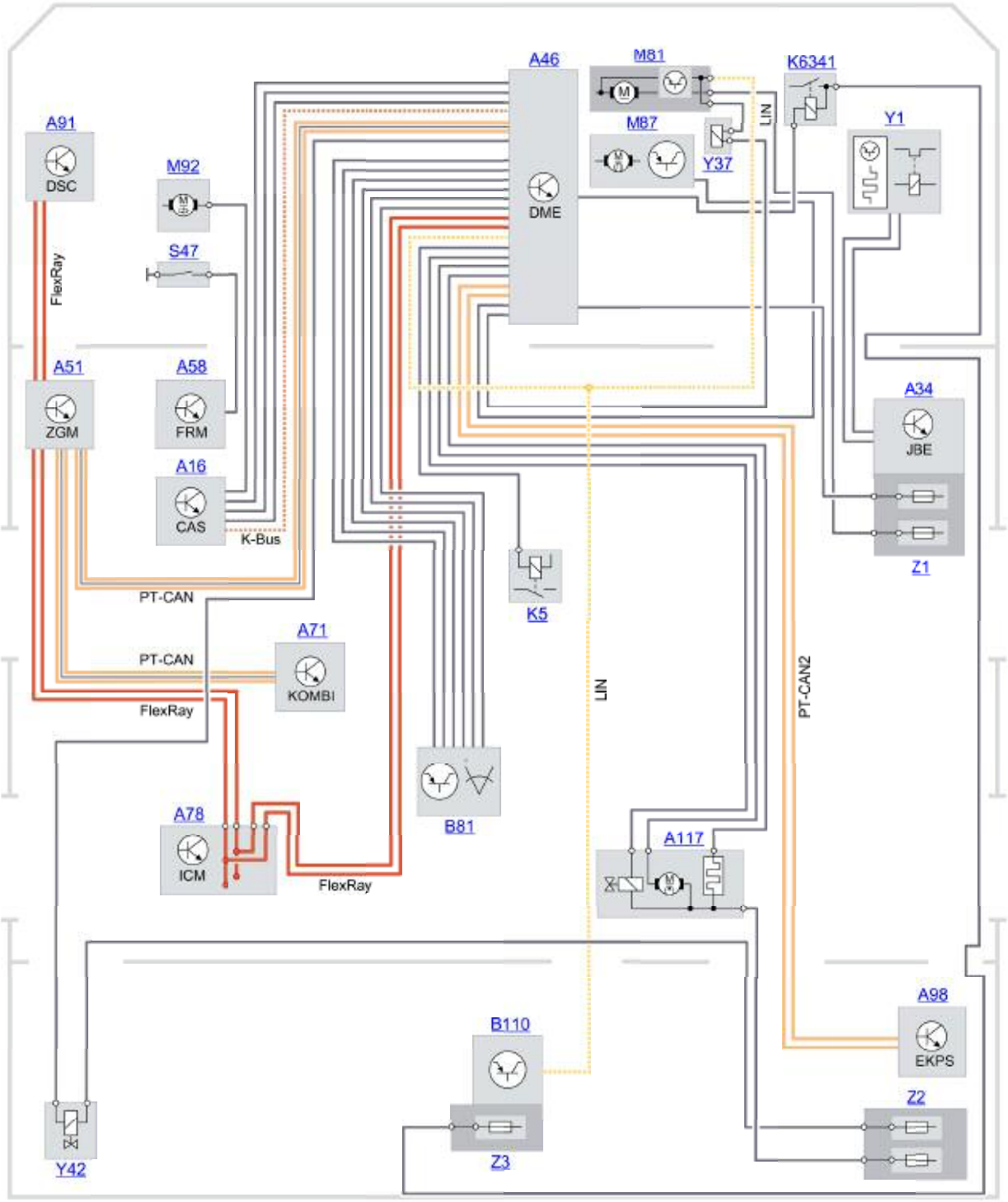
MSD80 (E7x): Inputs - Processing - Outputs



Index	Explanation
1	ECM (DME - MSD80)
2	Temperature sensor in DME control unit
3	Ambient-pressure sensor in DME control unit
4	DME main relay
5	Electric Fuel Pump (EKP)
6	EKP Relay
7	DM-TL
8	Electric fan (engine cooling)
9	E-box fan
10	Characteristic map thermostat
11	Fuel tank vent valve (TEV)
12	VANOS solenoid valve, inlet
13	VANOS solenoid valve, exhaust
14	Sound flap
15	Exhaust flap
16-21	Fuel injectors
22-27	Ignition coils
28	Electric coolant pump
29	Intelligent battery sensor
30	Alternator
31	Oil condition sensor
32	Ground connection
33	Diagnostics connection

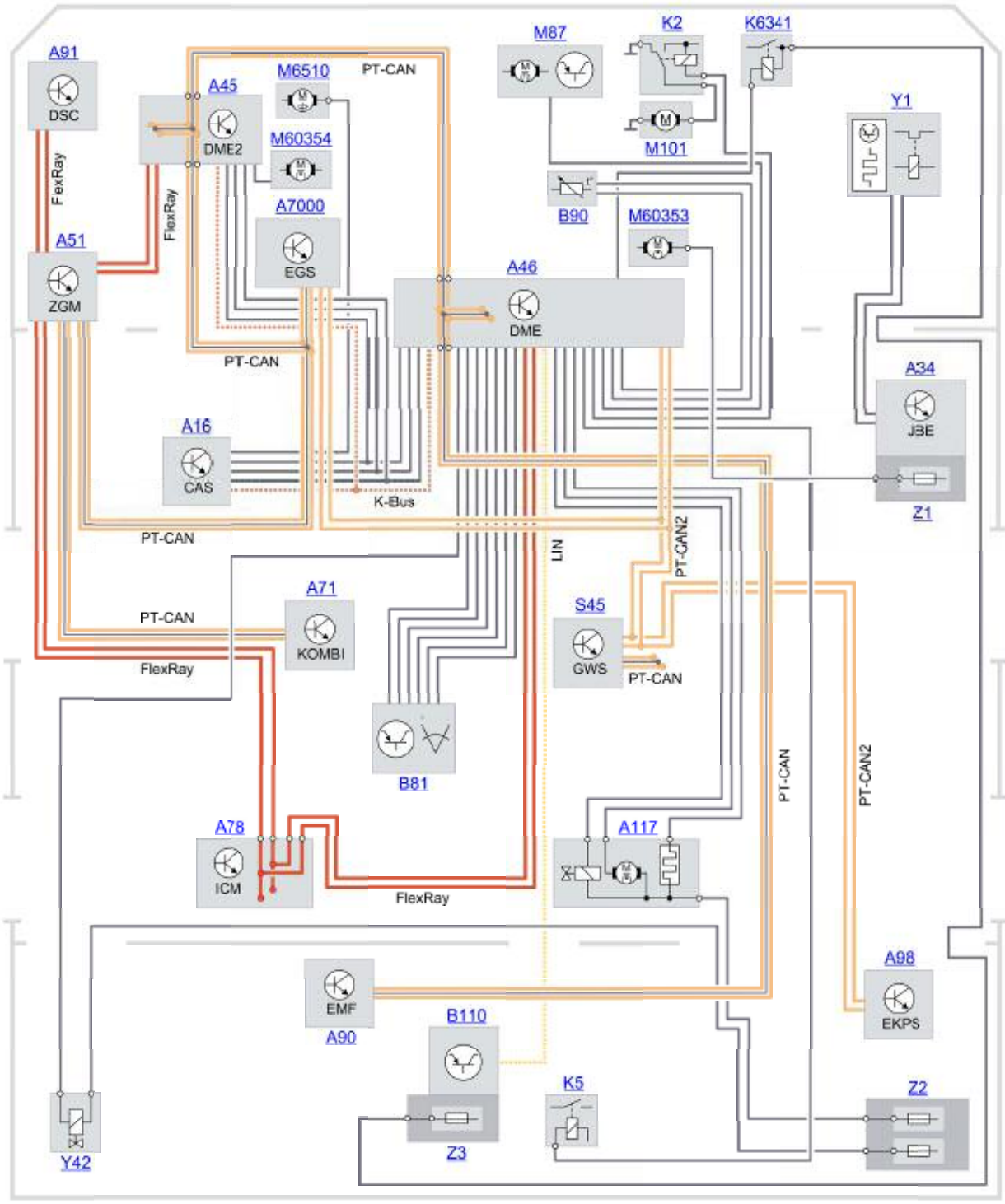
Index	Explanation
34	Valvetronic Relay
35	Oxygen sensor (secondary O2 sensor with discontinuous characteristic)
36	Oxygen sensor (primary O2 sensor with continuous characteristic)
37	Oxygen sensor (secondary O2 sensor with discontinuous characteristic)
38	Oxygen sensor (primary oxygen sensor with continuous characteristic)
39	Valvetronic actuator motor (VVT)
40-41	Knock sensors
42	Eccentric shaft sensor
43	Hot-film Air Mass Meter (HFM)
44	Camshaft sensor, inlet
45	Camshaft sensor, exhaust
46	Crankshaft sensor
47	DISA Actuator motor
48	DISA Actuator motor
49	Throttle valve
50	Accelerator pedal module
51	Coolant-temperature sensor at engine outlet
52	Coolant-temperature sensor at radiator outlet
53	DSC control unit
54	Brake light switch
55	Differential pressure sensor
56	Oil pressure switch
57	CAS control unit (Car Access System)

MSD80 (N52): DME Interface



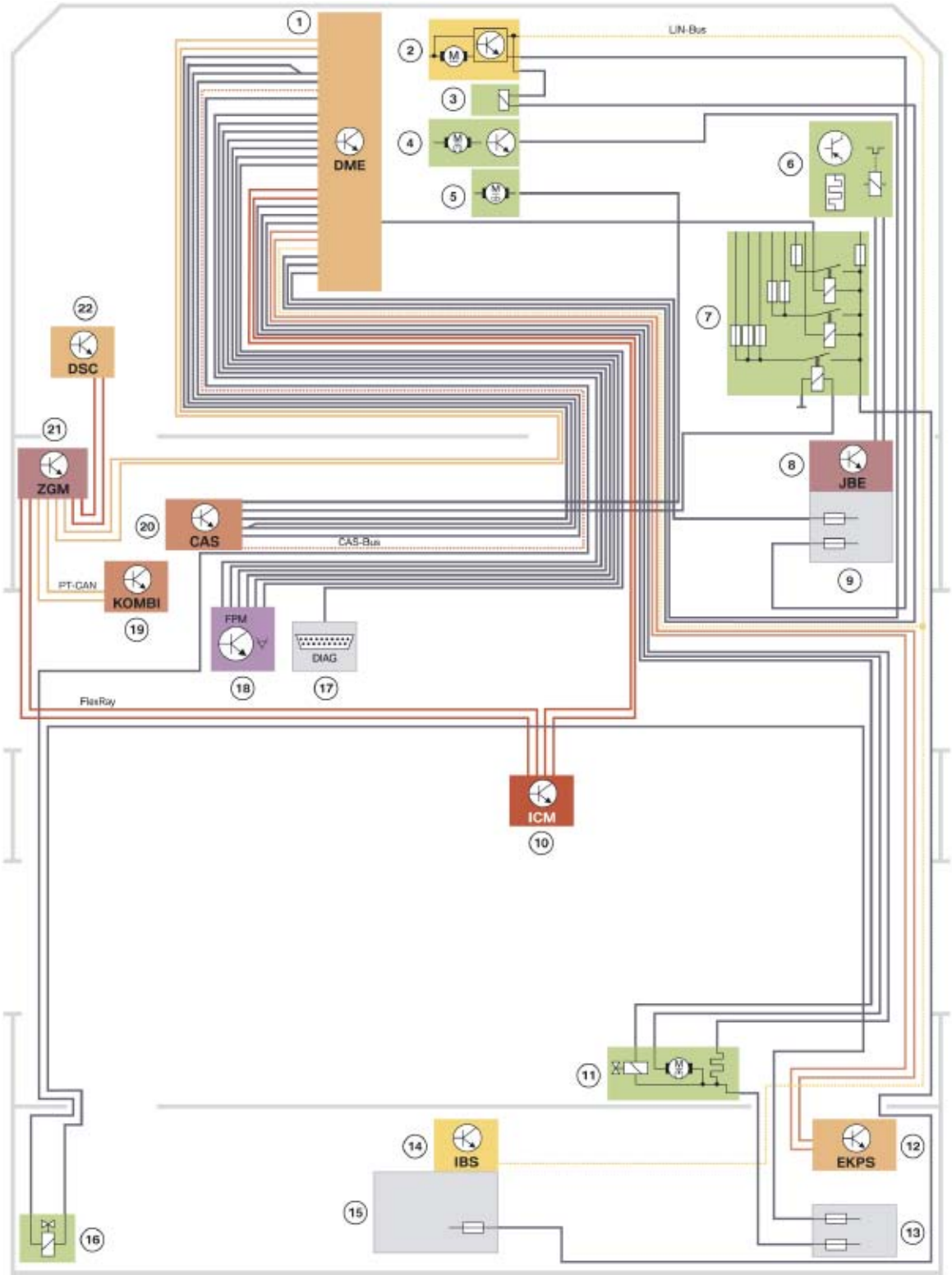
ISTA wiring schematic: SSP-BSB-T6109024 Motor interface N52

MSD81 (N54): DME Interface



ISTA wiring schematic: SSP-BSB-T6109019 Motor interface N54

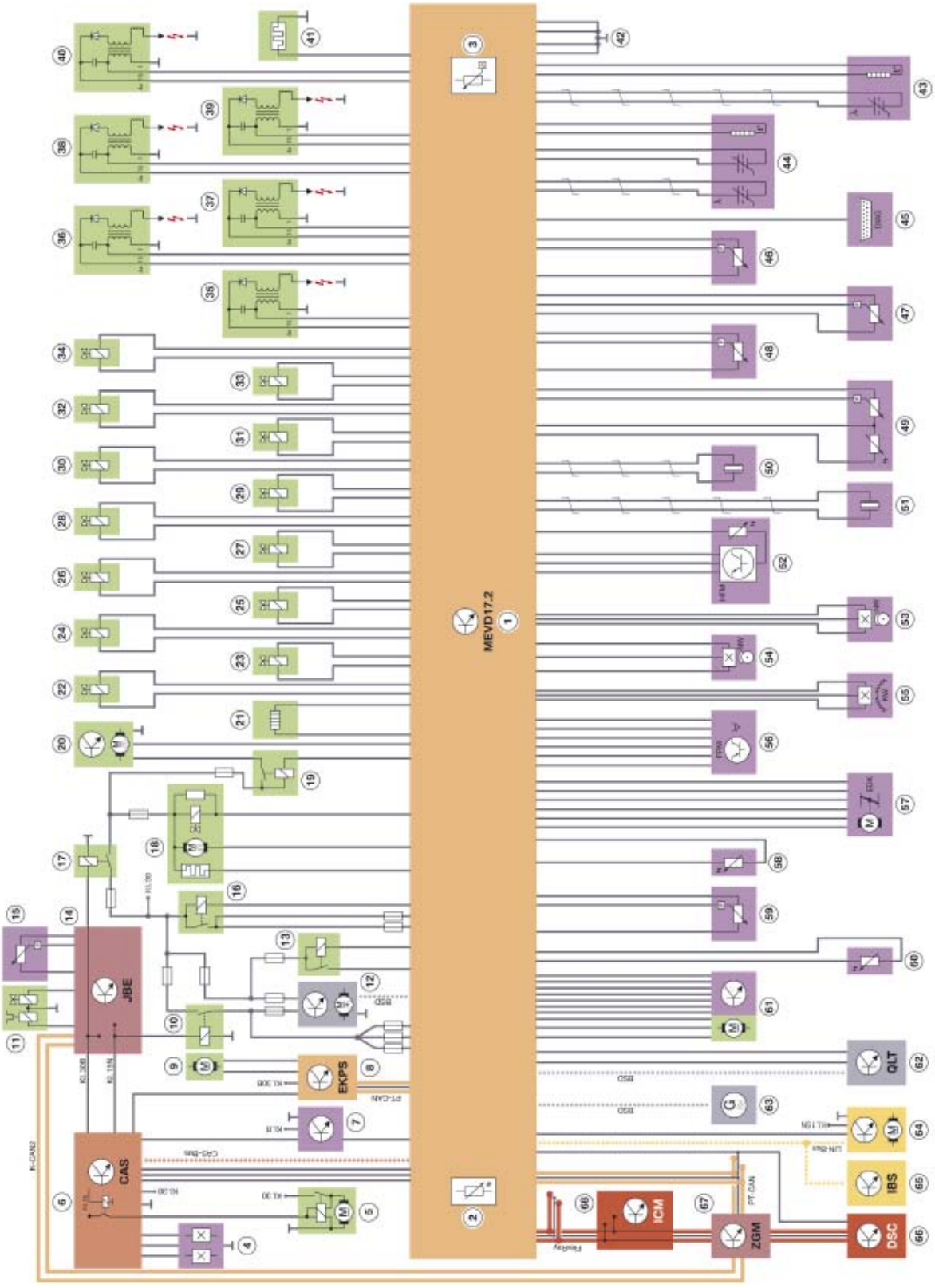
MEVD17.2 (N55): DME Interface



ISTA wiring schematic: SSP-BSB-T6109023 Motor interface N55

Index	Explanation
1	Digital Motor Electronics
2	Electric air flap control
3	Mechanical air flap control
4	Electric fan
5	Starter
6	A/C compressor
7	Front power distribution box
8	Junction box electronics
9	Junction box
10	Integrated Chassis Management
11	Fuel tank leak diagnostic module
12	Electronic fuel pump controller
13	Rear power distribution box
14	Intelligent battery sensor
15	Battery power distribution box
16	Exhaust flap changeover valve
17	Diagnosis socket (engine speed signal)
18	Accelerator pedal module
19	Instrument cluster
20	Car Access System
21	Central Gateway Module

MEVD17.2 (N55): Inputs - Processing - Outputs



Index	Explanation	Index	Explanation
1	Engine electronics Valvetronic, direct injection 17.2 MEVD17.2	35-40	Ignition coils
2	Ambient pressure sensor	41	Engine breather heater
3	Temperature sensor	42	Ground connections
4	Brake light switch	43	Oxygen sensor after catalytic converter
5	Starter	44	Oxygen sensor before catalytic converter
6	Car Access System (CAS)	45	Diagnostic socket
7	Clutch module	46	Low-pressure fuel sensor
8	Electronic fuel pump control (EKPS)	47	Intake manifold pressure sensor after throttle valve
9	Electric fuel pump	48	Fuel rail pressure sensor
10	Terminal 15N relay	49	Charge air temperature and pressure sensor
11	A/C compressor	50	Knock sensor, cylinders 1 - 3
12	Coolant pump	51	Knock sensor, cylinders 4 - 6
13	Valvetronic relay	52	Hot-film air mass meter (HFM)
14	Junction Box Electronics (JBE)	53	Intake camshaft sensor
15	Refrigerant pressure sensor	54	Exhaust camshaft sensor
16	Relay, ignition and injection	55	Crankshaft sensor
17	Terminal 30B relay	56	Accelerator Pedal Module (FPM)
18	Fuel tank leak diagnosis module (DMTL)	57	Throttle valve (MDK)
19	Electric fan relay	58	Coolant temperature sensor at engine outlet
20	Electric fan	59	Oil pressure sensor
21	Characteristic map thermostat	60	Oil temperature sensor
22	Diverter valve	61	Valvetronic servomotor
23	Fuel tank vent valve	62	Oil condition sensor
24	VANOS solenoid valve, intake camshaft	63	Alternator
25	VANOS solenoid valve, exhaust camshaft	64	Active cooling air flap control
26	Oil pressure control valve	65	Intelligent battery sensor (IBS)
27	Electropneumatic pressure converter (EPDW) for wastegate valve	66	Dynamic stability control (DSC)
28	Quantity control valve	67	Central Gateway Module (ZGM)
29-34	Fuel injectors	68	Integrated Chassis Management (ICM)

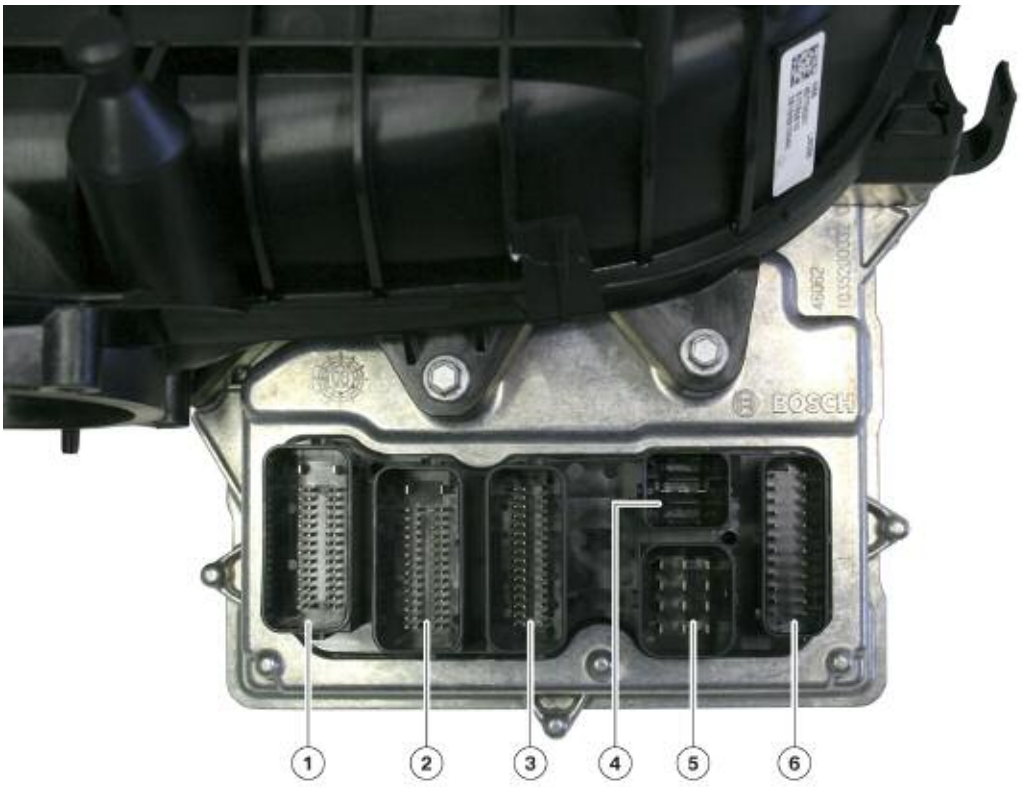
MEVD17.2 Control Unit

The N55 engine is equipped with the Bosch engine management MEVD17.2 :

- The MEVD17.2 is integrated in the intake system and is cooled by the intake air.
- The MEVD17.2 is FlexRay-compatible and directly supplies voltage to the sensors and actuators.

The top side of the DME housing also serves as the bottom section of the intake manifold. The housing is contoured in the area of the intake manifold to ensure optimum air flow. An O ring type seal is installed between the DME housing and the intake. The plug connections between the wiring harness and DME are water-tight.

N55, engine management MEVD17.2



Index	Explanation
1	Engine wiring harness, sensor 1 (Module 100)
2	Engine wiring harness, sensor 2 (Module 200)
3	Connection, vehicle wiring harness (Module 300)
4	Engine wiring harness, Valvetronic (Module 400)
5	Connection, voltage supply (Module 500)
6	Engine wiring harness, injection and ignition (Module 600)

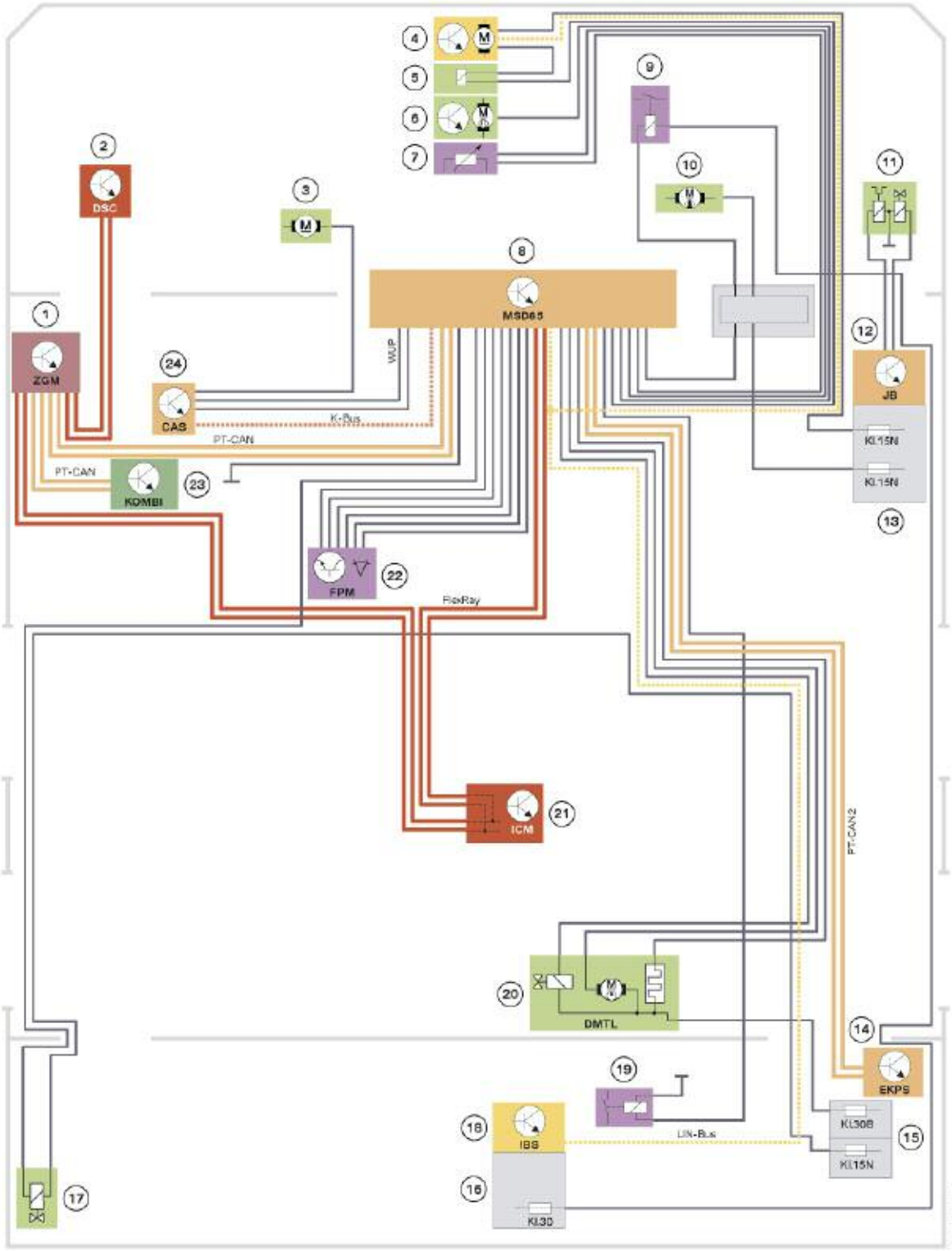
For the first time, an engine-mounted Digital Motor Electronics (DME) module is used. The DME is bolted to the intake manifold and is cooled by the intake air.

The engine mounted DME has the following advantages:

- Engine wiring harness is divided into six individual modules
- All electrical components on the engine are supplied directly via the DME
- The E-box is no longer need
- 211 pins are available
- The plug-in connectors are water-tight

N55, wiring harness routing

MSD85 (N63): DME Interface



ISTA wiring schematic: SSP-BSB-T6109021 Motor interface N63

Index	Explanation	Index	Explanation
1	Central gateway module	13	Junction box power distributor
2	Dynamic Stability Control	14	Electronic fuel pump controller
3	Starter	15	Power distributor, rear right
4	Active cooling air flaps	16	Power distributor, battery
5	Passive cooling air flaps	17	Exhaust flaps
6	Electric fan	18	Intelligent battery sensor
7	Coolant temperature sensor at radiator outlet	19	Electric fan relay
8	MSD85	20	Fuel tank leak diagnostic module
9	Electric auxiliary coolant pump for charge air cooling	21	Integrated Chassis Management
10	DME main relay	22	Accelerator pedal module
11	A/C compressor	23	Instrument cluster
12	Junction box electronics	24	Car Access System

MSD85 Control Unit

Due to the changes brought about with the new N63 engine, the engine management system has been adapted accordingly.

The new system, designated MSD85, works in conjunction with the High Precision Injection (HPI) system which is familiar from the N54 engine.

The high level of technology on the N63 engine place high demands on the DME system. The ECM used features a very powerful 150 MHz processor and features a new connector concept.

The connector concept consists of five chambers and functional configuration.
This means each chamber is assigned to a specific function group.

The following list outlines the configuration of the chambers in corresponding order:

- Chamber 1 (8 pins): Ignition
- Chamber 2 (59 pins): Engine plug, cylinder bank 1 and several central engine functions
- Chamber 3 (40 pins): Vehicle plug
- Chamber 4 (54 pins): Engine plug, cylinder bank 2 and several central engine functions
- Chamber 5 (16 pins): Fuel injection

An engine plug relates to sensor/actuator connections on the engine while the vehicle plug represents the interface to the vehicle specific components.

The functions of the engine management system are described in the respective systems.

The N63 engine is controlled by the MSD85. This control unit has been modified to make it compatible with the FlexRay bus.

The control unit is located to the front of the right-side spring strut dome. This control unit is liquid-cooled rather than air-cooled.

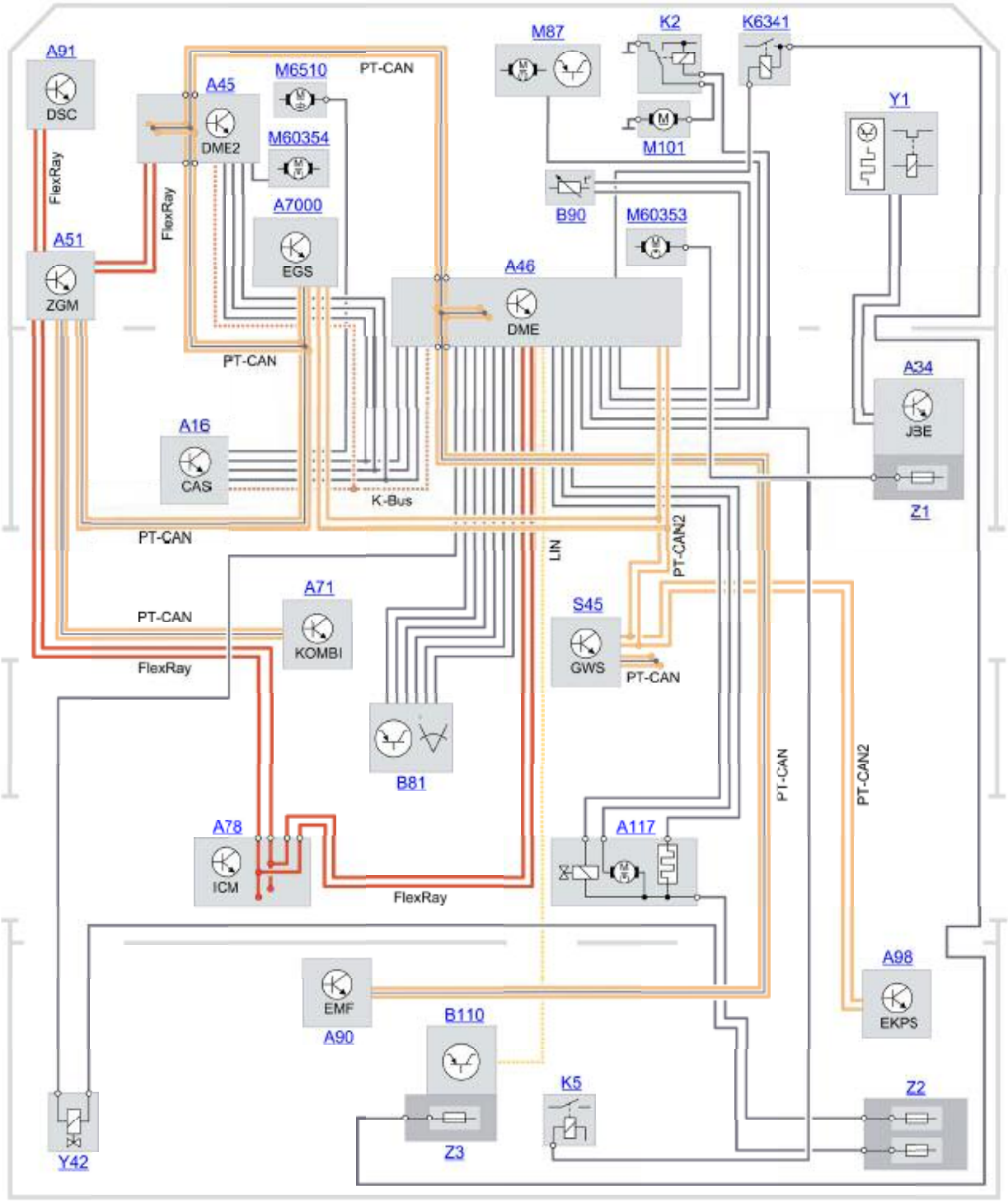
For this purpose, the housing of the control unit features two windings in the one coolant line, which is connected to the low temperature cooling circuit for charge air cooling.

The lower section of the electronics box is open to the outside. The upper section, which contains the connections, has a watertight seal.

Cooling of the engine control unit of the N63 engine

Index	Explanation	Index	Explanation
1	Sealing frame	5	Coolant line
2	Electronics box cover	6	Engine control unit
3	Coolant return	7	Electronics box
4	Coolant supply		

MSD87-12 (N74): DME Interface



ISTA wiring schematic: SSP-BSB-T6109020 Motor interface N74

MSD87-12: Control Unit

Two water-cooled MSD87-12 control units are used. The same water tight components as those on the MSD85 (N63 engine in the F01) have been used. As on the predecessor engine N73, a primary (master) and secondary concept strategy has been implemented with the two control units. They have the same hardware, software and data records. The connected sensor system runs an automatic primary (master) and secondary identification. In this arrangement, the master is responsible for communication with the complete vehicle and the specified nominal values for the engine functions. The control unit is designed with the current software for the vehicle network with FlexRay.

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